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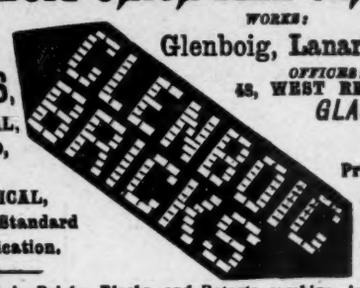

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CHANGE OF "JOURNAL" TITLE.

THIS is the last number of the "JOURNAL" that will appear under the old title of the "JOURNAL OF GAS LIGHTING," with which it was brought into existence on Feb. 10, 1849. Then the title was appropriate; it has long been a misnomer, through the limitation that "Lighting" suggested and conveyed. But notwithstanding that, week by week, there has stared us in the face the incongruity of contents with title, we have clung to the latter out of pure sentimentality. This can continue no longer. Sentimentality must give way to Time's changes. We have not, however, to seek for a new and compatible title. It has been an almost universal custom to abbreviate the old one to the "GAS JOURNAL." We accept the decree of custom; and henceforth the title will be—

"GAS JOURNAL,"

with an explanatory sub-title, indicating the subjects dealt with—Light, Heat, Power, Bye-Products. Simultaneously with this change, it has been decided to drop the Water Section, and to confine the contents of the "JOURNAL" to the affairs—technical, commercial, and otherwise—of the gas and kindred industries.

1916.

A Retrospect.

A YEAR ago our "Retrospect" closed with the fervent hope that the New Year would see the restoration of Peace through the decisive defeat of our enemies, and the world be again placed in a state of composure. That hope has been unfulfilled; but the position and strength of the Allies have, excepting in the case of Roumania (which entered the war against the Central Powers towards the end of the summer), been greatly improved. The Central Powers began the war with the intention, supported by a long, systematic, covert preparation, to enforce the principle of the paramountcy of Might over Right; to-day they are reading the lesson, through their internal conditions, and through the position on the Western and Eastern fronts, and on the seas, of the supremacy of the union of Might and Right. Might has had embodiment given to it by the Allies by the calling into action of dormant forces, which have progressively raised the military efficiency of the great allied nations in a measure that has been a surprise to the Central Powers, and has shattered their fondest hopes of placing the world under their domination, with Germany pre-eminent.

During the year, Germany has continued its diabolical war methods. The "Journal für Gasbeleuchtung" found unpalatable the description we gave of these methods in our "Retrospect" last year, and warmly protested. Whether or not our contemporary likes it, we adhere to the description, and emphasize it. The vile and murderous attacks on civilians—men, women, and children—ought to make every German with a conscience revolt at the very thought that he belongs to a nation guilty of such atrocities. Liners have again been torpedoed by German submarines; men, women, and children have found a watery grave. Unarmed merchant vessels of allied and neutral countries have been sunk without warning or any discrimination; many of their crews have gone down with them. Small fishing and other boats have been attacked by the submarine bullies, and sunk. This is German warfare on the seas. Aerial craft navigated by German hands have crossed the North Sea to this country, and have done no damage of military importance. But they have killed and maimed men, women, and children, and shattered peaceful homes. Do not the deaths, the screams, and the groans of these people—done to death and injured for life by bombs dropped by German hands from under the cloak of night and from a height—cause a feeling of disgust in the breasts of any of the German nation whom we were wont in days past to call our friends; or are the reports true that the massacre of innocent people and the suffering cause almost universally a fiendish joy among the Germans of all classes? And these are only specimens of the dastardly methods. Punishment awaits the authors of these crimes; and the Allies are as one in their intention, which has been hardened this year, not to lay down the sword, or silence a gun, or reduce the ever-growing output of munitions until punishment has been meted out, and until such reparation as it is within human power to exact has been made.

The people of Germany rejoice over the theatrical defeats of smaller powers; but the real war and issues lie with the larger allied powers. The navies of Great Britain and her Allies have prevented any resumption of the trade of Germany and Austria with the overseas parts of the world, and as far as possible with their neutral neighbours. The blockade of the enemy countries has been tightened during the year. The best that Germany could do was to retaliate by means of submarines—not retaliate on the blockading warships, but on both merchantmen and passenger vessels! Time and again the tension between America and Germany over the nefarious work of the submarines has been carried to the verge of breaking-point. On the Western and Russian and Italian fronts, the allied troops have severely punished those of the enemy. The desperate thrust that the Germans made on Verdun—Verdun their hope as the gate to the high road to Paris—met with partial success; but our valorous French colleagues through successive victories—the last of less than a fortnight ago being the most gratifying—pushed the enemy back again to where he was in February last. Verdun remains a monument to the destruction of German hopes, and to disaster upon disaster to the German troops. The general offensive that began on July 1 on the Western front has given us an almost continuous record of success. Admittedly territory recovery is slow work under modern warfare conditions; but the operations are proceeding with precision, and are having the intended result—that of gradually sapping the strength of the enemy forces. Hence the despatches from Sir Douglas Haig and our French Allies, marked as they are with a sincerely felt belief in our ability to gain the decisive victory, are extremely satisfactory. The magnificent successes on the Russian and Italian fronts further support the confidence in all the allied countries as to the ultimate issue of the war. Our flying corps has also covered itself with glory, especially in bringing disaster to raiding Zeppelins. We have had disappointments, but have philosophically accepted them, as no one can expect, when strong nations meet in conflict, that success on one side will proceed with unswerving regularity. There was the enforced—enforced through the shortage of food, and through time being against the relieving force—capitu-

lation of Kut by our sorely tried and heroic Mesopotamia force; but the closing days of the year see British forces again approaching the city. The gravest point in the situation is in Roumania. On the other hand, the Serbian forces, aided by French troops, have retrieved an important part of their lost country. Trouble with Greece has been well-nigh perennial, and the Allies have shown considerable patience—too much in the view of many authorities; but the end of the year saw them compelling acceptance of their demands, and rendering Greece impotent to treacherously intervene to the detriment of the Allies' plans.

The closing weeks of the year have also witnessed the British nation and her Allies showing new determination to vigorously prosecute the war. At home a national and business Government has been brought into existence, with Mr. Lloyd George as Prime Minister. The signs of reinforced vigour and power on the part of the Allies, the internal conditions of Germany and Austria, and the need for inspiriting the peoples of those countres, have combined to make the enemy reconsider his position; and reconsideration has produced certain farcical claims to victory warranting the magnanimous formulation by Germany of peace proposals which have been received with well-merited ridicule throughout the allied and neutral countries. Immediately following the fantastic display, the guns round the Verdun sector boomed; and many thousands more Germans became the guests of France.

The Commercial Position of the Industry.

Leaving the general situation of the war, to concentrate attention upon the immediate work and interests of the gas industry, every indication is that its prospects are remarkably good. While the war has brought its load of influences of a temporarily disparaging character, it has also enlarged the horizon of the industry, and quickened the pace of progress in directions where all prescient minds anticipated an eventual expansion. The industry is becoming more and more a fuel-gas one—the fuel gas of a character suitable for incandescent lighting. From the gas, through the war, light oils are being extracted for explosives purposes; and after the war the same light oils will have commercial value as motor fuel, for the manufacture of dyes, &c. In respect of gas consumers and gas applications, the fabric of the industry has been enlarged and strengthened during the year; thus continuing the tale of the Board of Trade returns for the years anterior to the war, and of the total figures for 1914-15 [see "Journal" for July 18], which totals, or similar ones, are all we are going to have during the war, owing to the need of economy of labour and expenditure (not essentially requisite) in all the Government Departments. More attention than ever is also being paid to coke utilization, with a view to obtaining as far as possible a permanence of the use which has been cultivated during dear fuel times. Tar dehydration is now on gas-works a common process which not only yields at the place of tar production the valuable light oils, but brings the tar into a condition to comply with the specifications of the Road Board. Greater attention, too, is being paid to sulphate of ammonia production. Furthermore, the industry has in mind schemes for the marshalling of its forces for the development of its own residual products. The industry has now a National Gas Council, watching over its interests. Opportunities have thus been enlarged; and prospects are good.

These are all largely developments, and gratifying ones, of the year; but the year has been for gas men—administrative, technical, and commercial—continuously seething with problems brought into being by the war, and all of which have more or less had effect upon the commercial position, or added to the worries and perplexities of the abnormal situation. There have been the subjects of recruiting and exemption, labour troubles in connection with war bonuses and wages, the question of the dilution of labour by the service of women, coal and oil supplies, prices, and freights, the higher prices and deliveries of goods, the insistent requirements of the Ministry of Munitions, pitch-stock accumulations, tar disposal and prices, sulphate of ammonia exports and the home demand, sulphuric acid, the Board of Trade circular as to reducing consumption for indoor lighting purposes while the Ministry of Munitions desired more benzol and toluol, and the further curtailments of outside lighting. Economies which meant reduction of otherwise maximum possible business came upon the industry while the prices of all its necessaries were higher—in some cases, unavoidably so; in others, through the inordinate and despicable appetites of profit makers in other industries, whose work has entirely deprived the Inland Revenue Commissioners of all hope of gaining "excess profits" from gas undertakings.

Concerning the causes of the lessening of gas consumption for lighting purposes. In the first place, the public-lighting restrictions proved their protecting efficiency against nocturnal air raiders, and were extended during the year to the whole of the country, excepting certain outlying parts, and their stringency was increased in the Metropolis and in the more vulnerable areas. There was the notorious 10 per cent. circular of the Board of Trade, which was too impracticable to be carried out, though more reasonable was the general appeal of the War Savings Committee to householders (especially the well-to-do) to exercise the greatest economy in the use of coal and gas and electric light. But the authorities unwittingly overlook the fact that for every ton of coal carbonized in gas-works about 12,500 cubic feet of good thermal value gas are produced, and (say) for sale 10 cwt. of coke, all of which can displace coal that is being destroyed by domestic and industrial consumption, besides producing much else of value for war and industrial needs. With the more stringent public lighting restrictions, this winter, also came greater surveillence over shop lighting, and the screening of the windows of all habitations, offices, and other premises; and succeeding was the general order for the closing of shops at eight o'clock on every evening but Saturday, when an additional hour is allowed. This order commenced to apply on Oct. 30, and will end on April 30. There was the daylight and artificial light saving scheme, which—after years of discussion, during which it was time and again dismissed as uncalled-for and impracticable—was, through the insistent demands of the war for the application of all means to economy, looked upon (subsequent to adoption by Continental countries) with favour; and a measure—known as the Summer Time Act—made speedy progress through Parliament, and duly received the Royal Assent on May 17. It was brought into operation four days later, and ceased on the morning of Oct. 1—representing during that time 133 hours of additional daylight brought into the active hours of that period. The Act, there can be no denial, has proved a popular one in the country; and the Home Secretary has appointed a Committee to inquire into its social and economic results, and to consider whether it is advisable to recommend its continuance next and subsequent years. The effect of the Act on gas consumption for lighting varied considerably in different gas-supply areas. Generally, it resulted in reductions in this branch of gas business, though, through the increased use of gas for domestic purposes other than lighting and industrial (and particularly munition) work, most gas undertakings showed on the total of their gas business a gain on the preceding year, though a reduction compared with 1913. The increased domestic and industrial uses of gas augur well for the future. This too can be said, that in all proposals that affected its business the gas industry made no opposition that it from its knowledge knew would be disloyal to the national interests.

Of course the increased costs of coal, oil, and labour, bore heavily upon the financial results of the industry, despite the additional charges for gas, and the higher values of the secondary products, about which more will be said in another section of the "Retrospect." Generally speaking, in the circumstances, sliding-scale gas companies—from the Gas Light and Coke Company downwards—made the profit required for the lower dividend to which they were entitled under the higher price of gas, and had something to the good, though in most cases small in amount. Some of the municipal undertakings from which profits are taken in aid of the rates, made lessened amounts; in other cases, where the full "pound of flesh" in the way of profit for this purpose would not be relinquished, the price of gas was put at a point sufficient to realize the amount needed. Not all municipal authorities can claim the wisdom in respect of profit appropriation during war time of the Middlesbrough Corporation, the Finance Committee of which decided that no profits should be taken from the gas and electricity undertakings in relief of the rates, owing to the refusal of the Local Government Board to sanction capital expenditure during the war. The profits are therefore being reserved for the requirements of the undertakings making them, which is a just proceeding. The Manchester Gas Committee (some of the members of which are old antagonists to profit appropriation) have sought to have the question

reviewed, having regard to the changed conditions due to the war and the consequent financial burdens, including higher income-tax. Reverting to gas prices, several concerns, in view of the greater cost of coal, notwithstanding the Price of Coal (Limitation) Act, the provisions of which did not give universally all the protection they were designed to impart, had to further increase the charges for gas early in the year. But the South Metropolitan Gas Company had the gratification of being able to lead the way with a reduction by 2d. off the war price of 2s. 10d.; this being made possible through the purchase and running by the Company of their own ships for the transport of coal. This reminds of economy. In every direction is being sought the economy of a greater efficiency. Old ways of doing things are giving place to new; and the smallest economy which represents true economy that can be realized is not neglected where there is good management—inside and outside the works; outside, for example, by the use of coke-fired steam lorries for the rapid delivery of coke and goods in districts of supply.

Some of the year's influences that affected one undertaking affected all; and, for the remainder, they were due to local characteristics and (relative to peace times) activity or depression due to the upheaval of normal circumstances. It would be useless in these times of irregular conditions to single out concerns for special mention, unless it be two. There was the Gas Light and Coke Company, which lost its eminent Governor (Sir Corbet Woodall, D.Sc.), who had established for himself a memorial in connection with the Company by accomplishing so much in regenerating it. The loss put into the Governorship Mr. John Miles and into the Deputy Governorship Mr. H. Jameson Waterlow, while Mr. D. Milne Watson was elevated from the General Managership to the office of Managing-Director. Then the Alliance and Dublin Consumers' Gas Company had their march in recuperation interrupted by the rebellion in Ireland. Considerable damage was done to the gas-works, and the development of business was consequently interfered with. It was reported that the Company's claim for compensation caused by the rebellion was £157,000. Passing from concerns of good repute, the United Gas-Works Development Company, who had gained some notoriety for their flotations of little concerns with magnificent titles and capitals, passed into the hands of a receiver, whose investigations disclosed "various regrettable facts." Enough said.

Abroad, excepting in places remote from the scenes of war, and having an independence in the matter of coal through local supplies being available—such as India, Australia, and the Cape—difficulties have been greatly intensified. In the matter of gas consumption, experiences, as in this country, have greatly varied. For instance, the last report of the Paris Gas Company showed a large reduction, while the European Gas Company exhibited a substantial increase. But coal supplies and rates of freight have been at ruinous figures for France and Italy, and other countries abroad depending upon British coal. The Continental Union Gas Company had again a gloomy tale to tell, through the Italian stations of the Union des Gaz, in which the former have considerable interests. Through negotiations between the Governments of this and the two Allied countries limitations were arranged for coal prices and freight rates. Even then they, combined, cause coal delivered to be at enormous prices for gas making. In this connection, the fixed charges for gas under the concession system obtaining on the Continent have been the cause of much difficulty. Municipalities both in France and Italy have resisted proposals for increasing the prices. But for the French Companies relief came through the action of the Bordeaux Gas Company in appealing with success to the Courts for a revision of the price of gas. In Germany, the reports indicate varied experiences in the matter of gas consumption. But in many cases, it is stated, there have been good increases due to the shortage of petroleum and the growing use of gas as fuel. Instructions were given, by the considerate German Government with an eye to its own requirements, to collieries to give gas-works preference in the matter of coal deliveries. But prices were liberally augmented—100 per cent. increases being mentioned in some instances and from (say) 30 to 60 per cent. in others. Information was published as to proposals for the liquidation of the Berlin interests of the Imperial Continental Gas Association. The Austrian gas undertakings suffered severely from coal shortage; and this interfered seriously with the gas supply. Restrictions to its consumption were general. In Vienna, for instance, the use of gas for cooking was forbidden. The position of certain of the South American companies was rendered much worse during the year—chiefly owing to coal supplies. In the case of the Primitiva Company, the situation became disastrous. They had for gas production to turn to the carbonization of wood, and make larger use of coke and oil; but a great difficulty was that the Municipality still refused to discharge their obligations in respect of payment for the public lighting. A great hardship to British gas companies operating abroad has been the payments of double income-tax, with the British tax at the figure at which it now stands. It is stated that some commercial concerns (we do not know of any gas ones) have, owing to this, transferred their offices from this country. The matter is causing the Board of Inland Revenue considerable anxiety; and arrangements have been made by them under which the relief afforded by section 43 of the Revenue Act, 1916, in respect of Colonial income-tax will be allowed wherever possible by way of deduction from the payment of United Kingdom income-tax, instead of by way of repayment. The subject of double income-tax is to receive detailed consideration by the Imperial Conference, and by the Committee on income-tax to be set up after the war. And about time, too.

British Commercial Gas Association.

Dealing with commercial matters, mention (though brief) must be made of the British Commercial Gas Association. It continued its excellent work; and special attention, distinct from ordinary routine affairs, was given by it to matters suggested by the war and to contemporary developments. Factory and workshop lighting, the use of gas in military centres and hospitals and munition works, the extension of the use of water-heating appliances, were among them. They issued, too, a challenge to the "Multicooker" people, who were gulling the public by ascribing to their appliances an economizing ability to the extent of 75 per cent. of the consumption of an ordinary gas-cooker. The challenge, on the conditions laid down by the Association, was refused, which refusal tells its own tale. The work of the Association burst forth in various new directions; and had it more money at its disposal, Mr. F. W. Goodenough, the Chairman of the Executive Committee, gives warrant for saying that it would all be profitably expended on behalf of the industry. The Association took considerable part in discussing and bringing before Government Departments many of the difficulties and problems that have assailed the industry through the war. A prominent part was also taken by it in the establishment of the National Gas Council—in fact, it is not too much to say that the illustration afforded by the Association of the power and usefulness of united effort did much towards pointing out and easing the way to the formation of the Council, to which further reference will be made later. However, the Association has fully established itself as a potent influence in the work of the industry, and this influence has been extended by the addition to its adherents during the year. With the promise of expansion of the work of the industry, and with increasing competition, the Association will be required more than ever. The record of lost opportunities in the industry has been too large for pleasant contemplation; and every means must be taken to avoid its extension. The Association is a means to that end. As Sir Hallewell Rogers, the President, said at the annual meeting, a "New Day" has come for the industry. There is a duty upon all concerned to make the most of it.

Sliding-Scale Effects and Capital Raising.

Mention has been made of the sliding-scale and the attenuating effect of its operation upon the dividends of some concerns. The year has felt an overflowing measure of the operation; and the large increase of income-tax to be deducted from the dividends has made the return upon investment shrink, in some instances, to a degree that, in times when the claims upon the individual are so heavy, has temporarily tarnished the good name of gas securities. This is a matter to which reference has been frequently made in the "Journal;" and therefore it was a satisfaction to hear Mr. Charles Carpenter, D.Sc., say at the February meeting of the South Metropolitan Gas Company (the words are applicable to other companies): "The constitution of the Company, if I may so describe the Acts of Parliament under which we work, was never framed to meet war times; and there is no doubt, in my mind, that the dividend pay-

able does not represent an adequate return for the risks and difficulties inseparable from carrying on a business of this particular complexity and magnitude, and that increase rather than diminish—in other words, that the sliding-scale is not giving even justice at the present juncture." At the annual meeting of the Gas Companies' Protection Association (which by the way, adopting the principle of co-operation and unity, has under consideration the extension of its membership to local authority undertakings), the matter was introduced of the refusal of the Committee to try to secure the suspension or revision of the terms of the sliding-scale during the war. But it was still thought by the Chairman (Mr. H. E. Jones), voicing the views of the Committee, that it was essentially a matter for individual concerns which thought themselves hard hit to take up with the parliamentary authorities, although Mr. Jones promised that, if events developed so as to show the necessity for a general movement, the question should be reconsidered by the Committee. Early in the year we published a *résumé* of a report by Mr. Nathan Matthews, to the Boston Consolidated Gas Company, upon a further investigation he had made here into the working of the sliding-scale. Had his investigation been instituted a little later, he would have seen that the sliding-scale system (beneficent as it is under normal circumstances) requires some protecting conditions for such times as those through which we are now passing.

However, the influence of the sliding-scale together with the new standard of return for investments set by the War Loan and Exchequer and Treasury Bonds, would have made it impossible for many gas companies to issue new capital (if sanctioned by the Treasury) within the limitations set by their statutory powers; and this will be the case for some years to come. As mentioned in our later references to parliamentary matters, various companies sought and obtained new financial powers conferring greater liberty in the making of new issues. Of course, the prohibition of the Treasury to the raising of any capital (except where it was proved necessary for providing gas supplies for munition work) has been an obstacle to the expansion of business that would otherwise have been possible. But, on the other hand, the price of all metal goods has risen considerably, and will probably do so still more in view of the interdiction of the use of all metals (unless consent be given) required for munition purposes. The combination of dear capital and dear goods is not the most favourable condition for the capital account. At the same time, there is great disadvantage in the discontinuity of business.

The National Gas Council.

The year has been marked by an event of the utmost importance to the future of the gas industry, and that is the establishment of the National Gas Council. An adequate representative body for the entire industry has been a favourite topic with us since the year 1909; it was patent even then that there was no organization in existence that could speak and act promptly with authority for the whole of the interests comprising the industry—administrative, financial, manufacturing, and commercial, as well as technical. The testimonials to representative insufficiency and immobility have been many; and yet every time until this year that the matter has been taken up, it has been, through some want of appreciation of actualities or petty jealousies, shelved again for a more convenient season, which never came, unless the most inconvenient time imaginable can be termed "convenient" because of positive necessity. The war and all its complex and harassing problems found the industry with separate organizations which could not act or speak unitedly without each one setting in motion its own particular machinery, and then endeavouring to make the separate parts work in unison, It was a complicated and very slow business, which was a detriment in approaching Government bodies to bespeak their help and sympathy; and it tended to deny to the industry proper recognition which the immensity of its operations really warranted. The war and its problems compelled the industry to action; and the irony of the situation was that the principal forces in the matter were men for whom place had never been found in the organizations, other than in the British Commercial Gas Association. The Manchester coal conference in May (convened by Aldermen William Kay and F. S. Phillips), at which a strong Committee was appointed to urge upon the Government the necessity of taking more effective steps for the coal provisioning of gas undertakings, showed that men of influence in gas administration were dissatisfied with the existing conditions and power of the industry's representation.

A long story could be told as to all that occurred leading up to the founding of the National Gas Council; but it cannot be related here. Briefly, representatives of the Councils and Committees of the Institution of Gas Engineers, the Society of British Gas Industries, the British Commercial Gas Association, and the Gas Companies' Protection Association met and discussed the situation and the requirements. The flow of words was great; negotiations were somewhat protracted. But eventually—this was at a general meeting on Oct. 3—the Council was established; and seven weeks later (on Nov. 21) we were able to publish the text of the constitution and rules. The Council (the first President of which is Mr. H. E. Jones) is composed of the Councils and the Committees of the four bodies already named. From the Council a General Consultative Committee has been elected, of which Alderman Phillips is the Chairman; and from the General Consultative Committee an Executive Committee (consisting only of representatives of gas undertakings) has been appointed, and of this Mr. D. Milne Watson is the Chairman. The full list of office-bearers will be found on p. 381 of our issue for Nov. 21. In the parenthetical remark as to the Executive Committee "consisting only of representatives of gas undertakings," is found the point of disagreement which caused the discussion preceding the establishment of the Council to be protracted. The scheme of concentration and unity of the various forces commenced with the fundamental idea of complete representation and participation; it ended in the Society of British Gas Industries supplying a constituent part of the Council and General Consultative Committee, without representation on the Executive Committee—the mainspring of the Council. Representatives of the Society are, however, to be co-opted when occasion requires. The position is not regarded favourably by the Society; it is held to be illogical by not a few disinterested men in the industry. Nevertheless, the Chairman of the Council of the Society (Mr. H. M. Thornton) and his colleagues pledged the members to loyally accept the decision in this matter of the majority of the National Gas Council during the period of the war, and to re-open the question of complete representation thereafter.

However, whatever happens in this regard in the near or the distant future, there is now in active existence a powerful and influential body representing the interests of the industry, and already engaged on valuable work. It is not the large organization that was first in the minds of those who advocated a fully representative body; but it certainly has the merit of not being unwieldy while representative, authoritative, and influential. One result of the founding of the Council is that it, the Institution of Gas Engineers, and the British Commercial Gas Association, will, it is hoped, before long be occupying better offices than now; and the eyes of those who have been advocating a central home and meeting-place for the industry now fancy that they can see rising upon the horizon the realization of their hopes. But as to the Council itself, the industry ends the year better equipped for advancing and protecting its interests than it was at the start of the year. The wisdom of this cannot be gainsaid.

Applications of Gas.

Still regarding the affairs of the year from the point of view of their bearing upon present position and prospects, while there have been particularly notable developments in connection with the industrial applications of gas, apart from that there has been no especially attractive development in gas-using appliances. In fact, shortness of labour and munition work made several of our manufacturers too busy to do more than keep present types equal to demand, and in certain cases there was inability to do so, and orders are in arrear. One of the first things that the National Gas Council have taken in hand is to deal with the question of the increasing difficulties that gas undertakings are experiencing in obtaining supplies of goods and materials necessary to the maintenance of the output of gas.

In regard to lighting, the only fresh notable development has been the introduction of the duct plan of high-pressure lighting by the James Keith and Blackman Company, which enables the system to be applied in the dusty atmospheres of factories, in units of power varied between wide extremes,

and by it light-giving power is maintained. Factory lighting was also a subject that, in the early part of the year, received much attention—particularly by the Illuminating Engineering Society. Zeppelin raids induced a larger consideration of the pressure-wave system of lighting and extinguishing street-lamps; and in Edinburgh some interesting and successful experiments were instituted with the "A & M" arrangement. Speaking of Zeppelin raids, it was also found by experiment at Edinburgh that—considerable differences of level notwithstanding—warning could safely be given to the inhabitants of the approach of airships by reducing the gas pressure some 50 to 60 per cent.; only a few consumers reporting that their lights had been extinguished. A special automatic valve was brought out by Mr. George Wilson, of Coventry, which is designed to be fixed between burner and tap, so that, immediately the gas supply is cut off, the valve closes, and does not reopen until released by pressing a small button. The question of the shortage of glassware supply—showrooms have borne witness to this—was frequently to the fore; and a good effect of the closure of trade with Germany and Austria is that several British manufacturers have taken up the production of heat-resisting glass. At the Sheffield University, the teaching of the technology of glass has already commenced. A number of lighting requisites were among the articles the importation of which was prohibited in the course of the year. The Travancore Minerals Company came frequently into the limelight; and steps were taken to completely eliminate from it German influence, and to assure British mantle makers of a supply, if required, of monazite sand from the deposits found in South India.

There were not any really new gas-fires placed on the market this season. The manufacturers are "marking-time" with the high efficiency fires previously introduced. In the first report of the Committee for the Investigation of Atmospheric Pollution, special allusion was made to the innocuous character of modern gas-fires compared with coal fires. At least two of the makers introduced neat combinations of gas-fires with a small cooking-oven at the top for use in such places as flats. There was an amount of information published in our columns as to the relative heating efficiency of internally heated and externally heated ovens; and excellent testimony—some of it independent—was given regarding the Potterton cooker. The destruction of house refuse—a sanitary proposal—by gas is a new extension of service. Considerable business has been done in the equipment with gas-ranges and water-heating appliances of military camps, hospitals, canteens, &c. A notable instance of the use of coke for a water-heating installation with a great number of draw-off points was supplied by the Lady Workers' Homes at St. John's Wood; and a description of it, with drawings, appeared in our columns. Among their multiplex work, the Executive Committee of the British Commercial Gas Association are considering what effective steps can be taken to prevent the fixing of geysers in bath-rooms without adequate flues.

The considerable application of gas to munitions manufacture of all kinds and sizes—including shells, small ammunition, and guns, large and small—opens up a vista of illimitable usefulness for gas in industry. Several articles dealing with furnace work appeared during the year; and a sign of the times is that there is a spreading institution of gas-furnace demonstration rooms. It is being freely recognized that the industrial gas business is something apart from other branches, and that its supervision should always be in the hands of technically trained men. The Birmingham Gas Department have particularly proved this, and have set an excellent example to the gas authorities of other large industrial centres. They found their high-pressure laboratory had more than justified itself, and so they have extended the scheme and the technical staff, with the view of undertaking the testing of metals and alloys, chemical analysis, and research and investigation work. For the services in these respects rendered to manufacturers, a scale of fees has been arranged to cover expenses, and make the scheme self-supporting.

Various subjects relating to power have been dealt with by Mr. H. C. Widlake, in special contributions to our columns. A new internal combustion pump was brought out by the Humphrey Pump Company, Limited. Considerable interest was aroused by the revival, by "Commercial Motor," of the proposal to use compressed coal gas in place of petrol for motor cars. Our contemporary stated that for this purpose coal gas was equivalent to petrol at between 8d. and 1s. per gallon, with gas at, after compression, 2s. to 3s. per 1000 cubic feet. Other comparisons were given in the "JOURNAL" for Nov. 14 (p. 352). The Gas Light and Coke Company are now converting two of their heavy commercial vehicles to run on coal gas; and they contemplate installing storage for compressed gas at their various stations for feeding motor vehicles. The Institution of Gas Engineers and the British Commercial Gas Association are investigating the possibility of using compressed coal gas for this purpose.

Surface combustion was heard of at intervals during the year; particularly from America, where the system is gaining favour. For shell work, the Eddystone (Pa.) Ammunition Company made a large installation of furnaces fired by the surface combustion high-pressure system.

FOR THE DEVELOPMENT OF INDUSTRY AND TRADE.

It is seen by the survey already made that there is good ground for regarding the business-expansion prospects of the gas industry as bright. It must also benefit by the work that is now being done to promote industry and trade generally after the war. More light, more heat, and more power must be required in any enlargement of the country's production—production by British capital and labour, through the eradication proceeding of enemy influence and capital. Real work is now being done in connection with industrial and trading expansion by bringing industry and science into closer relationship. Work had previously been going on in this direction; but not with the requisite universality and whole-heartedness. Interest has been aroused; the necessity of the companionship of science and industry is recognized. Committees are at work in every direction considering all manner of ways and means by which, through the universities, the technical schools, and chemical and physical research, material development can be gained. Whether anything good will issue from all these Committees cannot be foretold. It is true they have each and all a very big task before them; but there is nothing concrete yet to hand as the result of their appointment. One exception must be made. It is to be found in the Privy Council Committee for Scientific and Industrial Research, the President of which is Lord Crewe, and the Administrative Chairman Sir William M'Cormick. To the official members of the Committee, a Royal Charter has been granted. The new Department will receive a grant considerably larger than anything that has previously been allocated from the public funds for research purposes; and industries and firms are invited to make generous contributions, which will be exempt from income-tax and excess profits tax. Industrial associations will be formed in connection with various trades for the promotion of research. The research of individual workers will also be encouraged by grants. An economic conference of the Allies was held in Paris early in the year; and some far-reaching recommendations were made. A Committee was appointed by the Prime Minister to consider the industrial policy to be adopted after the war, with special reference to the conclusions reached at the Paris conference. It would take too much space to pursue this interesting subject; but there is no question that this country is resolved not only that the designs of Germany for subjugating British industry shall fail, but that the country shall be in a position to carry on more effectively than ever the competition for trade abroad. The matter of the patronage of enemy competitors after the war has been discussed by the Society of British Gas Industries; and Mr. A. M. Paddon has announced that an important group of gas undertakings in which he is concerned are determined not henceforth to buy enemy-made goods.

THE PREDOMINANT QUESTION OF COAL.

Overshadowing all else in importance during the year was the question of coal supplies and prices. The year opened with the position gloomy beyond measure, and there were forebodings which did not cheer as to what might happen during the present winter. Stocks were shrinking fast, deliveries were erratic and short, and complaints were generally rife. With the arrival of the usual time for negotiating contracts, the position worsened. While there were some colliery owners and contractors who were quite loyal to themselves, their customers, and the legislation that had been passed, as well as the steps taken to regularize supplies, there were others—and they were many—who sought to

make the utmost out of the war situation on their own account. This led to the application of artifice of all descriptions, chiefly in order to evade the provisions of the Price of Coal (Limitation) Act. There were coal owners who would not make offers, as in previous years, who sought to put interpretations on the Act that were foreign to its intentions, who refused to enter into contracts until they saw the topmost basic price of the year 1913-14 that could be commanded in this, and who preferred bargainings in the open market to making contracts. The position was illustrated by what happened to the Edinburgh and Leith Gas Commissioners. They invited tenders for their annual supplies, and instead of obtaining offers for upwards of a million tons as formerly, received quotations for only 10,000 tons.

The Board of Trade early in the spring issued a circular, urging that, as more coal was wanted for export, owing to the great reduction in the quantity of coal sent abroad having dangerously reduced our revenue from other countries, and for negotiations for supplies of materials required from neutral countries, there was—inasmuch as inland prices of coal had been kept "relatively low" by legislation and various voluntary arrangements—a "special obligation to co-operate with the Government to reduce in every possible way the consumption of coal whether in the form of fuel, light, or transport service." It was also pointed out that a 10 per cent. reduction in the home consumption would relieve for export 3 million more tons a year. The irony of this, when large home consumers were feeling the strong hand of restriction and of the weight of prices that were anything but relatively low, hardened the opinion that the Board of Trade possessed but a modicum, if that, of appreciation as to actualities. That this was so was shown as recently as the third week in November, when Mr. Runciman, President of the Board of Trade, admitted in the House that the question of certain collieries working short time was not due to the restriction of the export licences, but to difficulties in connection with the supply of tonnage. In such circumstances, it is hard to believe that the Board of Trade were earlier in the year well informed as to the position, and to see that any advantage would have accrued by reducing the home consumption of coal in order to release more for export.

The reduced working of certain collieries, and of other points to which there will later be reference, do not confirm the excuses freely made as to shortage of output and of available supplies for the chaos that was experienced at home in regard to deliveries, contracts, and prices. The real reason was that in greater part the coalowners were working for their own hand in the several ways already alluded to. There was early evidence, too, that, although they—possession being nine-tenths of the law—were able to look well after themselves, they had their eyes set upon securing an addition to the standard excess price of 4s. per ton specified by the Act, seeing that in not a few contracts it was stipulated that, if there was, during the term of the contract, an increase of the 4s., the coalowners should have the benefit of it by its addition to the contract price. There was also the condition (to which objection in the circumstances of railway and sea transport could not be legitimately raised) that deliveries to gas-works should be in equal monthly quantities, instead of 40 per cent. in the summer months and 60 per cent. in the winter months. This, of course, meant more expense upon gas undertakings for storage and taking from store; but it was an expense that it was politic to incur upon the grounds of expediency and of safety.

The Price of Coal (Limitation) Act.

Then before gas coal contracts were entered into, except with those undertakings that were prepared to make bargains at a price that suited the coalowners, there commenced a controversy regarding the interpretation of the Price Limitation Act, which resulted in a ruling by the Board of Trade which at once seriously depreciated the value of the Act, and which, if it had been originally intended, should have then been made clear.

There is in very active existence a body called the Gas Coal Federation; and it has had existence despite the protests that have (with well-simulated indignation) from time to time been made against suggestions as to combination and collusion in fixing market rates for gas coal. On behalf of that body, the Secretary of the Mining Association of Great Britain (Sir Thomas Radcliffe Ellis) obtained from the Board of Trade confirmation of his reading of certain provisions in the Act. The first question submitted by him to the Board was as to whether, in ascertaining the corresponding price for the prescribed year ending June 30, 1914, it is necessary that the contract of the same buyer should be taken, or whether, if there was a contract with another buyer, *nearer to the corresponding date* of the proposed new sale—providing the coal was of the same description, sold in similar quantities, and under similar conditions—that contract could be taken in fixing the price. The reply of the Board of Trade was that, "so long as the conditions prescribed by section 1 (1) of the Act are complied with, there is nothing in the Act which requires that reference should in all cases be made to a sale to the same buyer." In putting his case, Sir Thomas used these words: "If there was a sale within the prescribed period to any other person or company, nearer to the date of the new sale, *where the price was more favourable to the vendor*, provided the coal comprised in the last-mentioned sale was of the same description, and sold in similar quantities, and under similar conditions, the Act does not prohibit the price on such last-mentioned sale being adopted as the basis price for the price under the new contract." The words italicized show that Sir Thomas was only concerned for the coal vendors, and not for the buyers. The next point was also one of especial interest. Some buyers were of opinion that the basis prices which had to be taken were those ruling for coals *delivered* during the year ending June 30, 1914. But this, the correspondence with the Board showed, was not so if the contract was entered into on or before June 30, 1913. The Board of Trade said that in the case of a new contract reference must be made to a sale actually effected within the twelve months ending June, 1914.

These rulings created some amount of consternation among gas-coal buyers, as well as among many others. The Institution of Gas Engineers, through their then President (Mr. John Young), took up the matter with the Board; but the Board were not to be moved. Their reply was that, so long as the conditions prescribed by section 1 of the Act were complied with, there was nothing in it which required that reference should be in all cases made to a sale to the same buyer. The same buyer had previously been understood to be an important factor in connection with the Act. However, these matters in their various bearings were all discussed by us in March last; but a galling feature was that, while the Board of Trade interpreted the Act as conferring a large flexibility in the matter of arranging prices upon the coalowners, they piously hoped that buyers and sellers would exercise the spirit of sweet reasonableness in making their contracts—and this after the report of the Committee (of a year before) appointed by the Board to inquire into the causes of the rise in the price of coal.

In the course of the year, there was abundant evidence that the Act was being infringed by coal proprietors and contractors; but the Board of Trade consistently evaded the matter, and advised that those who felt aggrieved should use the process of litigation. Those who felt aggrieved were urgently in want of coal, and so were loth to do anything that would affect deliveries. The matter of evasion was frequently raised in the House of Commons—mainly by the late Sir Arthur Markham (himself a colliery proprietor), whose death has removed a thorn from the sides of the coal owners who are utilizing war conditions for their own profit, and a friend to fair coal dealings. He urged that the Act should be amended; and, on behalf of the Board of Trade, while it was acknowledged that complaints were being received as to the Act being infringed, there was evasion on the ground that no cases in which infringement was alleged had come before the Courts. The Board evidently could not see things from the side of the buyers, who were so much—legislation notwithstanding—in the hands of those who had the disposal of the coal. For instance, consider the actual facts as experienced by the buyers of coal, in conjunction with the statement on one occasion of Mr. Pretyman, the Parliamentary Secretary to the Board, that the conclusion the Board had come to was that the Act was working satisfactorily in the main, that the price of coal was largely kept down by it, and that it would then have done more harm than good to start a totally new basis. A similar attitude was taken by Mr. Harcourt when he said that complaints had been made from time to time by municipal and company undertakings with regard to the price of coal, and where sufficient particulars had been furnished, the Board of Trade had taken up the matter with those concerned.

He admitted that no doubt the Act was not always effective; but it could hardly be said to have failed in achieving its object, which showed the limitations of the knowledge of the Board as to the realities of the situation owing to influences of which buyers were at the time too painfully aware, with stocks low, deliveries erratic, and the terms that were being imposed upon them—though, we are pleased to say, not in all quarters; some gas undertakings, in fact, were able to speak of praiseworthy efforts to act fairly in each and every respect. The Board appeared to be oblivious to the fact that they could possibly be hoodwinked. On one occasion, Mr. Needham asked in the House whether it was true that coal was being sent from the Manchester district to Durham and Newcastle, and coal journeying from those districts to Lancashire. Mr. Pretyman replied that they could not trace such passage of coal. In one case only, he added, coal was being sent from Northumberland to Manchester; and, in this instance, he did not think any question of price was involved.

Standard Excess Price and South Wales Increase.

It has been mentioned that there was evidence that the coal-owners had, supplementing their schemes for securing larger profits, hopes of being granted a higher standard excess price than 4s. per ton above the contract prices applying to 1913-14. Incidentally, it may be remarked that 4s. meant roughly to the consumers of gas in the United Kingdom an addition of £3,600,000 a year. Of the 4s. the gas industry, in the circumstances of war, would not have complained, if only there had been strict and conscientious compliance. In the case of the Forest of Dean collieries, the Board allowed an increase by 1s. to 5s., and later to 6s. 6d. These collieries are exceptionally circumstanced; but it was the commotion, combined with the threats of the coal miners that followed the concession by the Board of another 2s. 6d. in the case of the South Wales collieries, making the standard excess 6s. 6d., that no doubt stayed further applications for an increase of the standard from other coal-fields and concessions by the Board. Although the matter was raised in the House, although Mr. Robert Smillie, the President of the Miners' Federation, attacked the legitimacy of the grounds on which the concession of the half-a-crown was made, no figures giving warrant to the concession have been advanced, but the Board have been content with mere generalities and secrecy as to facts. The nearest approach to explanation that could be obtained was a statement in the House by Mr. Harcourt, that the additional 2s. 6d. was granted in respect of an average increase of 2s. 6d. per ton in working costs. But did the Board of Trade know the "facts" as to the increase in working costs? It seems that they did not, inasmuch as in a letter (as recently as the beginning of this month) to the South Wales Miners' Federation, in which the Board made a conditional surrender to the miners of the 15 per cent. increase of wages for which they asked, it was remarked that the Board had determined to appoint an independent Auditor "to ascertain the facts in regard to the increase in the cost of production." Had the facts previously been in their possession, there would have been no occasion for this investigation. As Mr. J. E. Kenshole, the President of the Wales and Monmouthshire Institution of Gas Engineers, asserted, the enormous profits made and the handsome dividends paid by the colliery owners in South Wales and Monmouthshire showed that a grave mistake was made by the Board in consenting to the increase. It was admitted by the Board that applications were received for an increase of the standard price from three other districts; but two were rejected, and the third was under consideration. Had the course of events not been turned by agitation, there might have been a different tale to tell to-day.

The coal miners pushed a spoke into the wheel of possible events by threatening to put a stop to the rapacity of the coal proprietors and the bleeding of the workers of the country through the price of coal, by claiming additional wages in respect of such increases, and leaving work if they could not by other means realize their end. One result of the concession in South Wales was that the miners (as intimated above) made a demand for 15 per cent. increase of wages, as well as for thorough investigation by a joint audit of the accouts of the colliery owners. The owners, on the other hand, claimed 10 per cent. reduction of wages on the ground of increased cost of production, and would only consent to an audit in respect of certain periods. The miners and owners could not agree. The Board of Trade intervened to prevent the stoppage of the mines. There were negotiations; and still disagreement. Then there came the dramatic step of the Government taking over control of the South Wales mines, which was followed by the concession of the miners' demand of a 15 per cent. increase, pending the result of the audit to which reference has already been made. There was a still greater surprise in store for the colliery owners. The fall of the old Government was succeeded by conferences between the new Prime Minister and the various political parties; and to the Parliamentary Labour Party, Mr. Lloyd George promised that the whole of the coalfields should for the period of the war be brought under Government control. Government control means reduction of profits; and colliery shares—more particularly those of the South Wales district—suffered considerable diminution of market value.

Short and Erratic Supplies.

However, from the gas industry and the electricity industry, on these matters affecting prices as well as supplies, several deputations went to the Board of Trade and the Ministry of Munitions; and the deputations were always courteously received, and equally courteously informed, as regards supplies, that the Board were prepared to use their influence through the medium of the local Coal and Coke Supplies Committees which had been set-up with the view of exercising some control over supplies, more especially to works directly or indirectly engaged in munitions production. Gas-works are directly engaged in this direction, through the provision of benzol and toluol, and other necessaries to the war, as well as of gas for lighting, heating, and power to munition works, army quarters, and hospitals. The most effective action in stimulating influence was that taken when Aldermen William Kay and F. S. Phillips convened the memorable Manchester conference, apart from the gas industry's organizations. A strong Committee was appointed at the conference; and resulting from it were meetings with members of Parliament, whose knowledge of the matter was thereby augmented and whose interest was secured. There followed a deputation from members of Parliament and the gas industry to the Board of Trade; and though the result was regarded as satisfactory in some quarters, nothing very definite fell from the lips of the President of the Board, though he must have been forcibly struck by the nature of the experiences detailed, which experiences there is not the slightest doubt had not been brought to his notice by the much-favoured Coal and Coke Supplies Committees, whose work later was confessed to be partially ineffective through lack of compulsory powers. The aid of the powers possessed by the Admiralty, Army Council, and Ministry of Munitions were then brought into operation.

Prior to this questions in the House as to difficulties in obtaining contracts for full supplies always elicited allusion to the Coal and Coke Supplies Committees, who afforded most convenient cover, and who (Mr. Runciman stated) had "in some cases" been able to effect suitable arrangements. But the whole position pointed to the Committees being invested with inadequate power, though there was reference from them to a Central Committee, with Mr. W. F. Marwood, of the Board of Trade, as Chairman. And not only was the want of power a fault. There were people who pointed to the constitution of the Committees as representing in favourable degree the interests of coal owners, while those of consumers were inadequately represented. Their work was to collect information as to supplies, and to endeavour to influence deliveries. But apart from individual interests, the Committees not having legal power to suspend contracts in order to afford supplies to undertakings engaged on important work for the country, rendered nugatory any real effort on their part. Hence the order in Council empowering the Admiralty, the Army Council, and the Ministry of Munitions, after consultation with the Board of Trade, to issue directions as to priority in the execution of orders or contracts for the supply of coal or coke, with the view to securing precedence for all orders or contracts in accordance with national importance.

This change was not brought about before it was needed. Intelligence as to short supplies and diminishing stocks came from all parts of the kingdom. Ireland especially was in parlous condition; and the uncomfortable situation was one of the chief topics at the annual meeting of the Irish Association of Gas Managers. But here again expe-

rience and Board of Trade information appeared to be at variance; for Mr. Runciman in the House declared—this was in the autumn—that shipments of coal to Ireland had been so far well maintained—indeed, the quantity shipped in August was unusually large. There was the old transfer of responsibility in regard to prices. Said the President, it did not seem to be always understood that the Price of Coal (Limitation) Act applied to Ireland; and those who had reason to believe they were being charged excessive prices should communicate with the Coal and Coke Supplies Committee in their particular district. However, deliveries to gas-works, at any rate in England, improved during the autumn, which shows that the steps that had been taken to impress the authorities with the gravity of the position had had influence.

Supply Deficiency and Exports.

The deficiency of supply—an off-mentioned topic—was asserted to be due to the enlistment of miners; and, in passing it may be noted, coal mining became a badged occupation. The Board of Trade and the Government addressed themselves to making speeches, and using the arts of gentle persuasion, in order to get the miners and the colliery proprietors to mutually work for increasing the output. Prior to this, the Departmental Coal Organization Committee, of which Sir Richard Redmayne, the Chief Inspector of Mines, is Chairman, reported upon the decrease of output. The year 1913—following the year of the coal strike—was an exceptional one for large output and sales, particularly for export. The report stated that the output of coal in 1914 was 265,664,393 tons, or a reduction of 21¾ million tons on 1913. Later on, it was learned that the output in 1915 was 253,206,081 tons, or 12,458,312 tons less than in 1914. Very naturally this continued falling-off was, if not checked, a condition for alarm. Even so, it did not necessarily mean that there was an actual shortage of supply for this country; for the Coal Exports Committee had been busy controlling exports—partly with a view to preventing coal reaching, or being used for the benefit of, enemy countries, as well as to maintain an adequacy of supply for home use. Had the Committee not been active, the shortage of ships would certainly have prevented more coal being sent abroad. We frequently asked, What was the quantitative character of the deficiency about which so much was then being heard? In the "Journal" for Oct. 3, consideration was given to the matter on the issue of a further report by the Coal Organization Committee.

In the course of the comments that were made, it was pointed out that in the year 1914 the exports amounted to 59,039,800 tons, and in 1915 to 43,534,771 tons. However, if the inflated figure of 73,400,168 tons in 1913 be taken, it shows that in 1915 there was, in comparison, a reduction in exports of 29,865,397 tons. Turning to the beginning of the Committee's report, it is seen that in 1913-14 (the figures in this comparison are taken from August to July, to correspond with the war year) the total output of coal was 281,135,000 tons. In 1914-15, the output descended to 250,368,000 tons; but in 1915-16 there was a small recovery by 4,380,000 tons—the output being 254,748,000 tons. Now on the Committee's own figures, it is seen that the reduction of output, comparing 1913-14 and 1915-16, was 26,387,000 tons; while the reduction of exports was equal to 29,865,397 tons—that is a difference in favour of home supplies of no less than 3,478,397 tons. At the recent conference between the Government representatives and the coal owners and miners, the then Home Secretary stated that the deficiency of output was 15 million tons; but he did not explain how, taking into account the reduction of exports, this deficiency arose at home—whether through the requirements of munition work or what. The recent admission that there were collieries working short time, which Mr. Runciman asserted was due to shortage of tonnage, and his appeal to large consumers to stock more freely, puts altogether another complexion on the matter.

While on this subject, it may be mentioned that, from January to November this year, there has been a reduction of exports compared with the corresponding months of 1913 of 31,431,455 tons, and compared with the similar months of 1915 of 4,508,319 tons. But the value received for the 35,739,210 tons exported between January and November this year was £43,121,217, which was short by only £3,276,768 of the amount received for the 67,170,665 tons exported between January and November, 1913.

The Miners and Avoidable Absenteeism.

Whether or not there was a shortage of coal for home use, better far for the country that there should be maximum output; and, besides the appeals of the Government to the owners and miners to mutually work for it, there have been various schemes put forward—in the first instance by the Coal Organization Committee—to increase production. The proposals included the suspension of the Coal Mines (Eight Hours) Act, and the employment of more women and boys at the surface. These were rejected by the men; and the former was not favoured by the owners. The more profitable course was the prevention of avoidable absenteeism, which the Coal Organization Committee computed would increase the output by 13 to 14 million tons per annum, which would be about equal to the 15 million tons shortage that the late Home Secretary alleged now exists. The Mining Association and the Miners' Federation promised to co-operate in this direction. Pit Committees were formed. For a time there was a marked decline in avoidable absenteeism; but the patriotism of some miners—far from all—despite the silent calls of their colleagues at the front, sunk to such a low ebb that in the summer time the avoidable absenteeism was again on the increase, and fresh efforts were talked about. One proposal was that the miners of military age who refused to put in full time should be debadged and called up for military service, in order to allow miners at the front who were willing to work full time to be brought home again. The threat has been made that this will have to be done; but nothing definite has been settled. The Miners' Federation do not look favourably upon the proposal. They considered the question as to whether their power enabled them to inflict fines upon slack miners, which fines, they think, should be extended to those colliery managers who do not afford sufficient facilities for the men putting in full time. In the result, they have recommended the appointment of local Joint Committees, with power to inflict fines and penalties, under conditions noticed in our issue for Dec. 12 (p. 527). The perennial question of coal miners' wages cropped up during the year from time to time; the recent difficulty in South Wales being the most serious occasion.

Freights.

Extraordinary rates of freight continued to rule during the year; there being on the part of the Government no attempt at regulating them—one excuse for the high rates being the shortage of tonnage, and one apology for inaction the fact that regulation at home would not affect neutral-country ships, the owners of which could continue to charge what they pleased in view of the shortage of tonnage. The old Government appointed a Committee to consider the question of taking control of the mercantile vessels; but, if anything was done as a result of this appointment, it is not reflected in the rates of freight. The gas undertakings in and about London and round the coast dependent on seaborne coal have had to continue to pay high rates for transport, excepting where they possess their own ships. The exorbitant freights led the South Suburban Gas Company, it was learned from the Chairman (Mr. Charles Hunt), to transfer their coal contracts largely to the Midlands, so relying upon rail carriage. Rates of 14s. 6d. to 15s. 6d. per ton from the North to the Thames are terribly burdensome, compared with the rate of about 3s. ruling before the war. The advantage of private ownership of colliers was told by the late Sir Corbet Woodall at the last meeting of the proprietors of the Gas Light and Coke Company at which he presided—that was in February. He stated that, during the preceding half year, the running costs of the Company's ships was only 3s. 2d. to 4s. 11d. per ton, while the market rate of freight had just recently been up to 17s. 6d. per ton. Later in the year, Mr. Charles Carpenter, D.Sc., told the proprietors of the South Metropolitan Company that the acquisition of ships of their own had meant that, meeting all expenses (including the capital charges on boats purchased at war prices), transport costs only amounted to 4s. per ton. These facts show what a preposterous state of things prevailed. Yet the Board of Trade or the Government did not move. Their utter inaction in this matter is cloaked with mystery. The whole business has been bungled, owing to a studious regard to private interests in contradistinction to national ones. That 50 and now 60 per cent. of the excess profits goes to the State is no excuse for

the rates charged. Despite the percentage transference, the shipowners have been enriching themselves with remarkable speed, as is seen by the dividends declared and the state of their accounts; and the excess profits participation has only been an incentive to higher rates. But if gas undertakings in this country relying upon seaborne coal have suffered, more severely still have those abroad—both in allied and neutral countries—by the enormous rates of freight, instances of which can be gathered from the reports of various companies' meetings published in the "JOURNAL." Discontent was rampant—particularly in France and Italy; and negotiations ended in an agreement as to maximum coal prices and rates of freight. In the new Government a Shipping Controller—Sir Joseph Maclay, a leading Glasgow shipowner—has been appointed; the new Government having decided to do what the old Government ever shirked, bring the shipping industry under direct Government control. Before leaving the question of sea transport of coal, reminder may be given of the fight the little *Wandle*—one of the boats of the Wandsworth Gas Company—successfully made with an enemy submarine.

CARBONIZING MATERIAL OTHER THAN COAL.

Owing to the difficulties associated with the obtaining of coal for gas-producing purposes, a large amount of attention has been given in countries abroad to carbonizing other materials. In India and at the Cape, the gas undertakings have been relying, and with good financial result, upon the native coal. But in France the Société Technique du Gaz has been giving special attention to the subject of the carbonization of wood and other materials; and some very interesting information has resulted—notably in a report published in our issue for July 11 (p. 69). The French Ministry of Commerce appointed a Committee to study and to originate industrial processes for the distillation of fuels which do not yield coke, for the purpose of remedying the deficiency of coal and obtaining gas and certain secondary products. Then in Denmark, "turf," which probably means peat, is being utilized. In South America hard wood and oil are being largely employed with satisfactory results. In the "JOURNAL" for Oct. 3 (p. 21) some information was given as to a wood-distillation plant at Chopwell (co. Durham).

LAND TRANSPORT.

Regarding transport by rail, the pooling of their waggons has been largely adopted by groups of the Railway Companies. Success has attended an arrangement between the Great Northern, Great Eastern, and Great Central Railway Companies. Since then five of the other Companies—the Great Western, the Lancashire and Yorkshire, the London and North-Western, Midland, and the North-Eastern Companies—have come to a working agreement. In Scotland, the Caledonian, the Glasgow and South-Western, and the North British Companies have, it is understood, arrived at a similar working arrangement. As to waggons privately owned, the original proposal for pooling was not persisted in—the Board of Trade then concluding that there would be no saving or increase of efficiency by doing so. But this must not be regarded as final, for the Board with the Railway Executive Committee have been reconsidering the question of the efficient use of rolling stock generally: and an Order in Council has conferred increased powers upon the Board. They have now the right to enforce the prompt loading and unloading of waggons; and they may "as they think best in the interests of the country," take possession of any private owner's waggons. It is pointed out that, on occasions, private waggons, after being unloaded, are returned empty; and they might just as well be used for the conveyance of goods.

THE OIL POSITION.

Regarding the oil position, prices have ruled very high, and supplies have been short, which causes have largely reduced the employment of carburetted water-gas plants, with the result that more coal has had to be carbonized than would otherwise have been the case. The shortage is due in the main to want of tank-steamers; and, though America is busy building such steamers, they cannot have any immediate considerable effect in relieving the prevailing pressure. When it is mentioned that the cost of carrying oil from the United States to Beckton rose from the pre-war rate of 17s. 6d. to 125s. per ton, a tale has been told and an explanation made with brevity. In the face of all their difficulties, gas engineers were not a little perturbed at receiving, from the Director of Munitions Overseas Transport, a communication asking for particulars as to the quantity of petroleum gas or solar oil used by them, and inquiring as to the possibility of reducing the quantity consumed this winter. A meeting of representatives of the gas industry was held to consider the communication; and steps were taken to arrange an interview with the Director. Incidental to the main questions of the moment, it is to be hoped that the declaration made by Dr. W. Forbes Leslie is correct, that investigation has revealed the presence in Norfolk of an oil-shale of very considerable importance, and that his anticipation will be realized that in the near future the oil-fields of the Kimmeridge outcrop may be supplying much of the oil and petrol consumed in this country. This seems too good to be true.

FUEL ECONOMY—LOW-TEMPERATURE CARBONIZATION.

From the fuel economy campaign that has been proceeding throughout the year, the gas industry may expect to progressively derive advantage. Professor W. A. Bone, who may be said to have initiated the present interest in the matter, and who is Chairman of the Fuel Economy Committee of the British Association, has been very vigorously prosecuting the good work, in influential quarters, by lectures and addresses—notably before the Royal Institution, the Society of Chemical Industry, the Coke-Oven Managers' Association, and elsewhere. At the annual meeting of the British Association, the Committee reported on the progress of their work which at the outset is of an investigating order to ascertain the nature of the ground on which work has to be prosecuted—the investigations being conducted by sectional committees and in allotted directions. Professor Bone pleaded more than once for Government assistance; and before the close of the year, the announcement was made as to the Privy Council Committee on Scientific and Industrial Research (which, as already said, has now developed into a Government Department) taking over the work. In view of the importance of the subject in the national economy. the step, though belated, is the right one. The point was frequently made that there was a great economy to be achieved in the use of fuel by promoting the more efficient working of existing fuel-using plants; and in this connection the London Coke Sales Committee and their energetic expert (Mr. E. W. L. Nicol) were able to report excellent progress in the displacing of coal by coke for steam-raising. Chemists can do much in promoting fuel economy; but Professor H. E. Armstrong is not showing a good example. During the year he developed a strong partizanship for low-temperature carbonization as an aid in fuel economy; and, from his academical pedestal, he lectured the gas industry as to the error of their carbonizing ways. The Professor and other kindred theorists were dealt with by Mr. W. J. A. Butterfield in a brilliant series of articles in our columns. These articles (notwithstanding that Mr. Charles Carpenter on one occasion described the methods of the gas industry as largely empirical) showed that the industry in its utilization of coal is doing well in the interests of national fuel economy. The electricity supply industry also took up the matter, to see where they could assist; but their leaning is towards producer-gas (with bye-product recovery), and the burning of the gas for raising-steam for use in turbines.

Apart from Professor Armstrong as the self-appointed professorial champion of low-temperature carbonization, advocates of certain systems have considered the present (while fuel economy is being talked about, and light oils and the other products of coal carbonization are being required for war purposes) an opportune time to advance their claims to consideration as to low-temperature carbonization being the best solution of the problem of how to meet needs. But all low-temperature processes have their limitations. The yield of liquid products varies very much according to the coal used; the coal must be one which contains a high percentage of volatile matter which will produce large quantities of tar. Low-temperature processes, too, give the primary products of distillation—paraffins rather than the benzenoid compounds; and the paraffins spoil the benzol for the manufacture of pure chemicals and explosives. And Mr. E. W. Smith states—with regard to the claim made that the light oils produced from the low-temperature distillation of coal

would be useful as motor fuel—that it is overlooked that the percentage of unsaturated oils is high, and the cost of washing such oils might be prohibitive. The coke, too, has no real value for metallurgical purposes; and its uses are for domestic purposes at a price, or for employment in gas-producers as proposed in connection with the Coalite scheme for the supply to the Brighton Electricity Department of gas for electricity generating purposes, which scheme has not yet (so far as we are aware) been adopted by the Town Council. Mr. F. D. Marshall proposed a similar development of the employment of coke, with ammonia recovery, for the generation of electricity at a remarkably cheap rate per kilowatt hour. The Yorkshire Power Gas Company has entered into a contract with the Barnsley Smokeless Fuel Company (one of the Coalite progeny) for the supply of gas to them. Into the Barnsley Fuel Company, the Government put £10,000; but stopped there, and hoped that their first venture will not be all lost. They were not disposed to further assist the Company, as they could not see it would be of much service to them in the production of munitions. A good deal has lately been heard of the Maclaurin low-temperature process.

Benzol and Toluol.

The year has been alive with interest for all coal carbonizing industries, primarily on account of the increased requirement for benzol and toluol, and, secondly, because the trend of affairs directed the gas industry with firmer insistence than ever to devote ability and energy to the utmost development of its secondary products, for in that direction lies great economic promise. In his Presidential Address to the Institution of Mining Engineers, Sir William Garforth urged that coal should no longer be regarded as a fuel, but as a raw material; and in this one remark is seen the importance of the valuable constituents of coal being developed to the utmost extent, to assist in making the country in various ways more self-supporting than hitherto, and less dependent upon imports. This is a matter of economic concern to the nation. The Government should recognize it, and recognizing it, should encourage to the utmost of its power the industries devoted to this work. So far as the gas industry is concerned, its encouragement has been of a very partial character, and has given rise to complaints, as witness certain remarks at the recent meeting of the Southern District Association of Gas Engineers and Managers. Our universities and technical schools (the same in the United States) have established laboratories for the study of the liquid products of coal carbonization, and the derivatives of the distillation of tar and of the oil used for washing gas. There has been strong advocacy, too, of research being vigorously prosecuted not only into the processes of light oil and other recovery, distillation, and so forth, but of utilization of the derivatives in connection with dye manufacture and organic chemistry, for motor fuel use, &c. British Dyes Limited have established a strong department to this end so far as the dyeing interests are concerned; and this State-aided Company have brought to their assistance the most competent ability to conduct and supervise the work. It has been made abundantly clear during the year that the gas industry must keep in close touch with these advancing movements, and keep abreast of them with its own developments in other directions, or it will find itself left out in the cold, to its permanent detriment. Now presents an opportunity that may never recur; and what is being done in the recovery of benzol and toluol, and in tar and oil distillation, and so forth, are the roots to a large development after the war of secondary product work in the interests of the gas and other industries and the country generally. The plant that has been brought into existence, and the work that has been done, must not be wasted after the war; it will certainly be required, if the right procedure is adopted. In this connection, among the events of the year has been the formation (and in this Mr. Charles Carpenter, D.Sc., has taken a very prominent part) of the Association of Chemical Manufacturers, which has been established in order to meet German competition after the war, to promote closer co-operation, and to place before the Government the views of the chemical trade generally, to promote further industrial research, and to facilitate the closer co-operation of the chemical manufacturers, the several universities, and the technical schools.

Campaigns of various kinds in connection with the country's work have been many this year. The gas industry has had more than one; but one vital to its progress and to the country has been that which has had for its object the supersession by the oil-washing of gas of the inefficient process of tar-washing, which, as we recently showed, was an old German proposal of thirty years' standing, and which was largely adopted by the gas industry, as most quickly and inexpensively adaptable in the emergency in which the country found itself earlier in the war in respect of high explosives. It answered its purpose as a bridge to the more efficient process of oil-washing, which has been, and is being, adopted on a large scale in the gas industry, at the request of the Explosives Supplies Department of the Ministry of Munitions, in the work of which Mr. F. L. Halford has applied himself (with Mr. W. Doig Gibb) with a devotion in which self has been entirely eliminated. In the work of promoting the oil-washing of gas, the names of many other men readily come to mind. There are Thomas Glover, H. O. Carr, John Bond, A. E. Broadberry, (the President of the Institution), John Young (the ex-President), Harold E. Copp, Hubert Pooley, Geoffrey Weyman, (the late) J. G. Newbigging, Isaac Carr, P. D. Walmsley, G. T. Purves, D. Bagley, and numberless others. Beckton, Norwich, Manchester, Tottenham, Etruria, Wombwell, and other places have opened their gates to demonstrate to gas men what is being done, in order to promote the introduction of the greater efficiency of the process. Many gas-works that could do so have not adopted the oil-washing of gas. Indifference to the national interests or else a fear as to evil effects (which experience shows need not exist) have stayed the application; and at the Southern Association meeting in November there were many well-supported suggestions that the Government should make oil-washing compulsory, as has already been done by the Italian Government.

Difficulties (including that of naphthalene), methods of working, effects, and much else associated with oil-washing have formed the subject-matter of numerous articles and papers published in our columns. We cannot allude to these matters here; it would absorb too much time and too much space to even skim them. But they make a valuable collection, full of instruction and guidance; and, before this great accumulation of experience, difficulties vanish—if only one proceeds to work in the correct way, and give to the process the necessary supervision. We may here particularly direct attention to the articles and papers by Messrs. Glover, Doig Gibb, Bond, Carr, Weyman, Purves, Walmsley and Morfey, and Bagley; and there are various contributions from the coke-oven industry which are full of experience. Mr. George Stevenson contributed a paper to the Midland Association, in which he essayed to show how the limestone process increased to an extent the benzol and toluol in the gas.

In the course of articles and papers, it has been shown that the development of the process of extraction of benzol from gas is a good paying proposition. America has found this out; and has acted accordingly, to its great commercial benefit. But the gain in this country has not been universal. Where there have been gains in the new direction, there have been losses on tar and pitch. Many works practising tar-washing have not had the enrichment of the tar recognized by tar distillers; and so they have not been greatly encouraged. Apart from this, for economic reasons, tar dehydration and oil distillation is a growing institution in gas-works. The former will be referred to later on; the latter is an essential part of the oil-washing system, in that the transport of the wash-oil a distance for the removal by distillation of the light oils is not an economic procedure, and it delays the reapplication of the wash-oil. That small gas-works can adopt the system is shown by Wombwell; and other works of small output were referred to by Mr. Carr at the recent Southern meeting. Oil distillation could not be well adopted by the smaller works; but it could be carried on at one works by a group engaging in the business co-operatively.

Calorific Power—The New Act.

There is no question that the need of the war, and its effects upon the fuel, dye, and motor industries, have had, in the course of the year, a greater and more rapid influence upon the natural developments of the gas industry than in normal circumstances would years of hard toiling work. There has been opposition to this development from various quarters; but the obstructionists have failed in their purpose, which is the proper fate for opposition born only of ignor-

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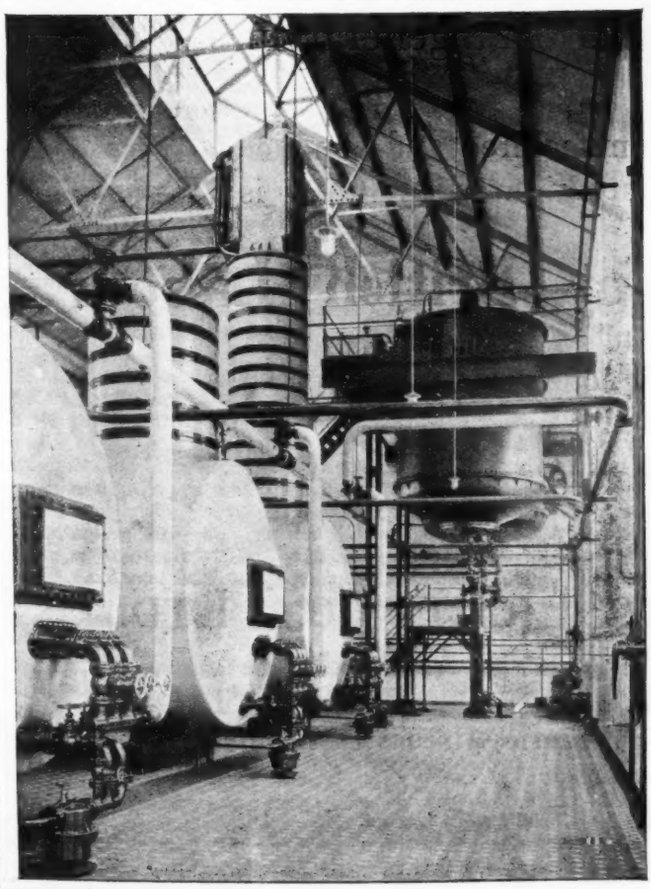

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ance or of self-interest. It was seen in the unpatriotic but sporadic clamour for reductions of the charge for gas (despite the influences of the sliding-scale and competition in keeping down the price) as compensation for the removal of benzol from the gas; it was seen during the discussion in the House of Commons on the Gas (Standard of Calorific Power) Bill, when chemical manufacturers, who saw in the Bill a vehicle for the development of the bye-products interests of the gas industry, sought to have, with a new-felt solicitude for gas consumers, certain conditions attached to the granting of the substitution of calorific value for illuminating power as the standard quality of gas; it was seen when local authorities opposed company applications to the Board of Trade for the change, and sought to have time limitations or a higher standard applied than had been approved by Parliament, while other equally important local authorities owning gas-works were asking the Local Government Board for the same calorific value standard. There was failure all along the line. Parliament and the Board of Trade saw the necessity for the change; and they recognized that, under the current use of gas, the thermal and not the illuminating power quality was the natural standard, that it was the only possible one to work to in the imperative demand for benzol, and that it was the one if in future benzol was to be recovered from gas for the needs of industry instead of being wholly consumed as a constituent of gas.

The Bill was introduced to the House early in June. It gave the Board of Trade and the Local Government Board power to grant Orders for the substitution of the calorific value standard for the illuminating power one. On Aug. 15 we published the text of the measure as passed. The only change worth noting that had been made in it—this was in the House of Lords—was that the Board of Trade and the Local Government Board could, if thought desirable, impose a higher minimum pressure for gas than that commonly prevailing. Applications began to be made to the two Departments; and some of the non-gas-supplying local authorities (some of them electricity suppliers) began to sharpen their wits to see in what manner they could make use of the occasion to exact conditions from, or get conditions imposed upon, those companies who were making application. There was complaint from the gas industry that, as the Government desired more and more benzol, there should have been protection against such opposition, which to at any rate small companies meant an expense that could ill be borne in these times. In the Sheffield and Cheltenham cases, the local authorities and others whose imagination ran riot against proved facts, put up as strenuous a fight as though it was a contentious Bill in Parliament that they were opposing, instead of a purely natural development. The inquiries have been conducted with great tact by Mr. Garnham Roper, of the Board of Trade, who has had the assistance as technical adviser of Mr. W. Doig Gibb.

The first Order made by the Board was that referring to the Sheffield Gas Company; and it showed conclusively the course that the Board were prepared to take, and that they, at the request of local authorities, were not inclined to place any obstacle in the path of progress. In the Order granted, the Board prescribed 500 B.Th.U. gross or total heat value; 15-10ths minimum pressure; and gave to the Company and the Corporation the right of a quinquennial application for a revision of the standard. In our columns, Mr. John F. Simmance had urged that applications should be framed so as to provide for apparatus being used in testing the calorific power of the gas which would give to it its maximum heat value; and, in the Order, the Board provided for the use of any testing apparatus agreed upon between the Corporation and the Company, or, failing agreement, the apparatus and conditions prescribed by the Metropolitan Gas Referees. The number of applications for Orders has not yet been so great as we anticipated. But it is growing; and now that the Board have given proof of their intentions, and it has been intimated that they are not going to hold further inquiries without exceptionally good cause can be shown, the number should quickly increase.

In the course of the year, a large amount of interest was shown in America in the question of the adoption of calorific value as the standard for gas supply. Various standards were fixed, or inquiry is being made with the intention of making prescription. We cannot enter into particulars here; but they will be found recorded in the volumes of the "JOURNAL" for the year.

COKE.

Benzol and toluol are not the only secondary products of the gas industry that have held interest during the year. Interest extends to coke, tar, and sulphate of ammonia; and the gas industry has to exercise a great deal of care to see that the advantages secured during the war are continued to the largest possible extent after it. The commercial advantages in regard to market prices (except in the case of pitch and refined tar) have helped to save the industry from the disastrous position in which it would otherwise have been projected by the price of coal delivered; but the commercial advantages have been accompanied by many questions of a technical character, and, in connection with pitch and sulphate of ammonia, by conditions that have caused a great deal of anxious thought and discussion.

Coke has been much in favour as a fuel. The position of the coal market and the difficulties of transit were impelling forces in its favour. The coke position has, indeed, been the reverse of that which preceded the war, when coke yards were unpleasantly loaded with stocks. A great deal of credit is due to the London Coke Sales Committee, to Mr. E. W. L. Nicol, their expert, and to the British Commercial Gas Association, for what they have done in fostering the opportunities for development, and obtaining influential patronage. Especially in large electrical stations—the London County Council electricity generating station at Greenwich may be cited—other institutions, and factories, where fuel is required for steam-raising, there has been considerable adoption, as well as generally for heating in industrial operations and for domestic purposes. This all constitutes a big advertisement, and will carry much influence into the future. Mr. Nicol is of opinion that, if gas undertakings would only contribute for propaganda work 1s. per 100 tons of coke made, the money would be well expended to establish the market hereafter—more especially seeing that, if the gas business is to develop as is hoped, coke production will increase. Suggestions have been made, too, that coke might be used in producers (with ammonia recovery) for the making of power and heating gas for industrial centres, either for consumption in gas-engines or under boilers for steam-raising. Coke as a fuel for motor vans and lorries is also developing. In this connection (as the British Commercial Gas Association have announced), District Committees are being arranged through the Commercial Sections of the District Gas Associations for the organizing of depôts for the supply of coke on the principal motor routes throughout the kingdom, on similar lines to those already established in the South of England by the London Coke Sales Committee. This Committee have recently produced a new type of welded steel water-boiler heated by coke, and known as the "No. O London."

TAR.

In connection with tar, there have been two main subjects of discussion—the ugly accumulations of pitch stocks through the high rates of freight obtaining, and which have closed the foreign markets that formerly absorbed a large proportion of the output; and the question of tar dehydration or distillation. For the relief of pitch accumulations (which the larger they get must affect the greater the pitch market after the war), the schemes discussed were its carbonization, its use for briquette making, and its employment as a road binder. From the gas makers' point of view, there is little advantage in carbonizing the pitch other than the commercial one of keeping-down accumulations, and then the pitch must be obtained from the tar distillers at a reasonable price. But offers quoted in our "Correspondence" columns for pitch for carbonizing purposes were generally such that the only conclusion to be drawn from them was that some of the tar distillers did not want to ease the market for fear they would have to pay an enhanced price for tar. However, the experiments carried out in carbonizing pitch disclosed that up to 5 per cent. of the weight of the coal could be carbonized without creating difficulty, and in some instances modest advantages were shown, but above 5 per cent. trouble was experienced with stopped ascensions and the thickening of the tar in the hydraulic mains. But even with 5 per cent., proper intermixing with the coal was essential. At the same time, 5 per cent. must not be taken as universally applicable; different qualities of pitch and coal might require some variation in order to achieve the best results. But if

all gas-works could absorb pitch to the extent of 5 per cent. of the weight of coal carbonized, it would about represent the quantity of pitch they produce. We described during the year the Smethwick briquette plant, and its commercial results; and information was received as to other works investigating this use of pitch. As to road work, there has been a fall in the demand during the war, although with the heavy traffic, road maintenance should have very careful consideration.

As to tar dehydration, it has become quite a common feature among gas-works processes. While most works have adopted specially constructed plants, there are others—such as at Whitstable, Horsham, and Slough—whose engineers have constructed home-made plants that are rendering good service. Details of the working of dehydration plants have occasionally come under discussion. There is every reason for encouraging their use from the economic standpoint, not only on account of the war requirements for light oils, but in view of the use of dehydrated tar for road purposes, in connection with which the Treasury consented this year to the Road Board making money grants up to £200,000 for road spraying, tar macadam, and road repairing. The point was made during the year that in view of the temperature to which the Ministry of Munitions desired that dehydration should be carried in order to recover all the phenols, there was such a thickening of the tar that it could not be economically applied for road purposes. But the thinning-down by the use of 10 per cent. of creosote oil overcame all difficulty. In the annual report of the Commercial Section of the Southern District Association last month, it was stated that the gas companies who had erected tar dehydration plants had obtained good prices—from 6d. to 9½d. per gallon—for the light oils. The demand for tar for road purposes, it was also stated, had been good; and last year's prices had been maintained in most cases. The Plymouth and Stonehouse Gas Company obtained statutory powers to acquire an existing tar distillery, and to purchase tar from any gas undertakings in Devon and Cornwall; and there is no doubt that the question of combination between groups of gas-works in the matter of tar distillation is one which bids fair to materialize, as it has already done in Germany through the Verband Deutsche Gas Fabriken. The principal incentives to such developments are the local use of tar for road purposes, the saving of carriage costs to a distance, the requirements for dyes, and motor and Diesel engine use, and the attitude of many of the tar distillers in the matter of prices. It is all a question with gas-works of making the best use of their tar to the general advantage of their business.

Sulphate of Ammonia.

Sulphate of ammonia has also been a commodity that has caused a great deal of anxiety and perplexity, chiefly through the intervention, with most excellent intention, but misplaced confidence, of the Board of Trade and the Board of Agriculture and Fisheries; and, secondly, owing to the difficulty over sulphuric acid. Had it not been for the activity of the Sulphate of Ammonia Association (and especially of the energetic Chairman, Mr. D. Milne Watson), the position of affairs for sulphate of ammonia would have come to a very bad pass. By the way, the last published returns show that the production represented by the Association is no less than 325,447 tons, which is well on the high road to complete inclusion of British makers large and small. It should be borne in mind by those makers who have not become members that the work the Association has before it is one of as grave importance—and more so, in view of the permanence of the conditions to be met—as that which has so largely occupied them this year in negotiating with the Government authorities. Though something like three-quarters of the home production of sulphate of ammonia had theretofore been exported, the issue of export licences was stopped for a period, as authority entertained the fear (which was not shared by producers) that there would be a shortage of fertilizers at home. Arrangements, too, were made by which prices were fixed for home consumption; but these were not approved by many farmers, who had hoped that the stoppage of exports would create a glut, and reduce prices to a low level. There was a great deal of agitation in the House and elsewhere over the matter. Fears were dissipated, and so were the hopes of the farmers, whose laxity in purchasing largely resulted in stocks accumulating to such an extent that at last the authorities saw the necessity of rescinding their prohibition, and recommencing the issue of licences. In all these matters, the Sulphate of Ammonia Association were called upon to exercise much discretion, and to take upon themselves a large amount of responsibility: and sulphate of ammonia manufacturers are much indebted to the chief actors in the matter for the skilful manner in which an awkward difficulty was handled. The annual report of Messrs. Bradbury and Hirsch for 1915 was as usual highly interesting.

But the past of the market is not so important as the future, when Germany's competition is in full swing. A German newspaper not long since stated, with reference to nitrogenous fertilizers, that the works now in operation in Germany were producing at the rate of 300,000 tons of sulphate of ammonia per annum; so that not only were the agricultural requirements of Germany fully covered, but sufficient quantities were also available for the manufacture of high explosives. The "Frankfurter Handelsblatt" also asserted that the production of nitrogen in Germany is going to exceed all expectations; and large extensions of the Badische Company's plant for the synthetic production of sulphate of ammonia were reported. Truly the home production in future will require very careful handling! As to home consumption, this has increased; and it is to be hoped that the current movement, in which the Board of Agriculture are taking a large part, for the enlarged production of foodstuffs in this country will increase—it promises well to do so—the consumption of sulphate of ammonia. Some correspondence has recently appeared in "The Times," in which Professor Somerville and Mr. Milne Watson have taken part with the view to the stimulation of home use, which should also be encouraged by an article in the "Journal of the Board of Agriculture," in which it was pointed out that the superior solubility of nitrate of soda as compared with sulphate of ammonia rendered it liable in a heavy shower of rain to be washed away and entirely lost. Mr. John West, in our "Correspondence" columns the other week, gave some notable figures as to the increased value obtained per acre of land by the use of sulphate of ammonia.

A matter that caused much anxiety during the year was the supply and price of sulphuric acid, partly owing to Government requirements, to shortage, and to what the Sulphate of Ammonia Association described as the "scandalous manner" in which the acid makers were taking advantage of the shortage. Through the intervention of the Association, the Government brought sulphuric acid under control at prices which, though lower, were still very favourable to sellers and burdensome to buyers ["Journal," Feb. 15]. Later came the advice to use nitre cake in partial relief of sulphuric acid, but the poorer ammonia quality of the sulphate was a detriment. The arsenical variety of acid was also discussed; but it is not liked, principally on account of the discoloration of the sulphate of ammonia by the association with it of sulphide of arsenic formed in the saturator by the precipitation of arsenic by the sulphuretted hydrogen. Methods of eliminating the arsenic were discussed in our columns. It is quite likely that the production of sulphuric acid will be undertaken in larger degree than heretofore by carbonizers of coal. In his annual report, the Chief Inspector under the Alkali Works (Regulation) Act mentioned the question of certain gas-purifier troubles, which had arisen owing to the introduction of the direct sulphate of ammonia process, but which troubles he did not think were insurmountable. Mr. G. T. Purves recently discussed, in a paper read before one of the Scottish Junior Associations, the question of higher ammonia yields by a consideration of carbonizing temperatures.

With regard to the competitors of sulphate of ammonia, nitrate of soda has suffered in the British market from the fact that it is an imported article, and not a home-produced one. At the beginning of the year, it was under the disadvantage of high freights and short tonnage; and this is a condition that has gone from bad to worse. The demands of this country, of our Allies, and of America for nitrate of refined quality for explosive purposes grew apace; and our own Government bought largely to ensure ample supplies. The Panama Canal difficulty also had its effects upon the supply and the market. The large expansion of the productive power of nitrogen from the air in Germany, and the synthetic production of fertilizers has already been referred to as a factor in the *post*-war competition. The new electric nitrate works in Germany are stated to be "numerous"—at all events Germany has succeeded in providing itself

with all the nitrate it requires, both for explosive and agricultural purposes—that is to say, according to German report, which is not always accurate. In the Patents Court, an application was granted to the Gas Developments Company, of Walsall, for licences to use three German patents for the manufacture of ammonia from hydrogen and nitrogen by the synthetic process. The transformation of cyanide, or lime nitrogen, into ammonia is now carried out in Norway, Germany, France, Switzerland, Italy, Japan, and prior to the outbreak of war in Belgium. Canada has an extensive plant, and the United States is also working in the same direction. At the meeting of the Nitrogen Products Company, information was given that cyanamide is being sold in considerable quantities for chemical purposes, and that the whole of the output (quantity not stated) of granular nitrolim had been sold for the coming season. It is asserted that the latter will be especially useful where the soil is poor in lime, seeing that, in addition to nitrogen, it provides a supply of lime and carbon. Information was also given to the effect that large works for the production of nitric acid and nitrate of ammonia by the catalytic process are in course of erection. But as yet the shareholders are looking for tangible cash results. However, the information goes to show that after the war sulphate of ammonia derived from coal carbonization will have to be circumspectly handled, in view of the enlarged competition to which it will certainly be exposed.

Gas Labour during the War.

In regard to labour in the industry, this has been a constant source of anxiety, principally owing to the needs of the Army and Navy—the requirement for every fit man of military age who could possibly be spared becoming more and more imperative with the progress of the war. The industry has been pretty well drained of its military-age men who could be released without actually jeopardizing the gas service to the public and the maintenance and increase of the supply of benzol and toluol. It was soon apparent that, even with its peculiarly favourable claims for the retention of men, the gas industry was to undergo a further combing-out. The Institution of Gas Engineers and the British Commercial Gas Association were kept fairly busy in this matter, in the general interests of the industry; and it was made clear that the Ministry of Munitions would resist any attempt to unbadge men who were essential to the upholding of the supply of benzol and toluol.

The details of the whole matter are many; but the final phases are by far the most important to the industry today. They arise out of the request of a few months since of the Man Power Board to the Board of Trade (Reserved Occupations) Committee to reconsider the whole list of certified occupations. A deputation from the Institution and the British Commercial Gas Association waited upon the Committee in October, and had the pressing need for more recruits urged upon them. The Committee evinced a strong desire to ascertain in what ways exemptions at present granted to employees of gas undertakings could be revised without endangering the supply of gas to the public and of high explosives to the Ministry of Munitions. An explanation as to the difficulties of winter in gas-works gained the sympathy of the Committee, who deferred any further consideration of the matter until the spring, but declined to extend protection to men who were not in the industry at Aug. 15, 1915. The Committee are convinced there are wide differences between what has been done in some undertakings and what has been done in others in the direction of employing women, and in training boys and over-age and military unfit men to take the places of men fit for service. In the spring, therefore, the Board of Trade Committee will require that every able-bodied man of military age who can be spared from the industry shall be released for service. Since the deputation referred to, a Special Committee of the National Gas Council has been appointed to conduct negotiations with the Reserved Occupations Committee in regard to recruiting next spring; and, as recent communications showed, the assistance of the whole industry is desired in collecting data to place before the Committee. The Hon. Secretaries of the Council (Mr. W. E. Price and Mr. F. W. Goodenough) have pointed out that, both in reference to the reservation of essential men and the certification by the Ministry of Munitions of orders for goods and materials, those undertakings that are washing their gas with oil are sure to receive more favourable consideration than those washing by tar. Towards the end of the year, instructions were issued to the Military Tribunals regarding the discontinuance of the exemption of men under 26 years of age, unless urgently required for work of essential national importance, and men whose qualifications render them really irreplaceable.

The employment of women grew largely in the gas industry; but, as said above, the authorities have a suspicion that not so much has been done by some undertakings in this direction as might have been. The Home Office and the Board of Trade issued a leaflet showing the many occupations in the industry in which women had been engaged, and had not been found wanting; but it is a case of getting the right class of women for the right work, though several undertakings seem to have managed to do so to their advantage in view of the depleted state of their staffs and ranks. The experience of the South Metropolitan Gas Company, Mr. Carpenter tells us, is that, generally speaking, the women are capable of about two-thirds of the work of the men in the same time; and therefore this is taken as the basis of their pay.

The contributions payable under the Unemployment Section of the National Insurance Act was another matter that caused an amount of trouble to the gas industry. Among other decisions, the Umpire determined that contributions were payable in respect of gas-works men and munition workers engaged in the extraction of light oils from tar or oil, and of all classes of workmen engaged in the distillation of tar; also in respect not only of those engaged on the repair, but those employed on the cleaning, of gas-cookers. Mr. Frank Livesey urged, in a letter in our columns, that the gas industry should resist the farcical decisions of the Umpire. The principles that guide the Umpire certainly appear to be to exclude workmen whom the Act would benefit, and to include those who were not likely to require any benefit, but from whom contributions could nevertheless be extracted.

Taking the gas industry as a whole, its workmen are generously treated. In most places, first one and then a second bonus in view of high food prices under war conditions were voluntarily granted. Notwithstanding, the trade union leaders took every opportunity of trying to foment discord; and a good deal of trouble and anxiety was caused by the demands made, discussions necessitated, and threats issued—more especially in connection with municipal undertakings. Our columns during the year have borne much evidence of this; but fortunately, generally speaking, strikes have been averted. At the Edinburgh gas-works, the boiler men threatened to come out; and the works were brought under Government control. At Dublin there was a brief strike of certain of the distribution men. The concession by the Government of an additional war bonus to the railway men—raising it from 5s. to 10s. per week—caused some trouble to other employers. Without considering the conditions of labour, and without troubled consciences, trade unions sought to make the 10s. the standard to be applied to men no matter their rate of pay. The Gas Light and Coke Company were met with an attack of this kind, and raised the war bonus from 7s. to 10s.

Regarding labour generally, the most important happening has been that the Trade Union Movement has at length, under the new Government, realised a hope that has been cherished by it for the past twenty years or more. That is the Institution of a Ministry of Labour. The President is a member of the Labour Party in the House—Mr. John Hodge, who has already given proof of a large practical appreciation of what the duties and functions of his office should be. There is confidence that in his hands the bonds between Labour and the State will be strengthened, and those that should exist between Labour and Capital will, it is hoped, be largely improved.

The Works and the Distribution System.

Although there are no large new works, constructions, and extensions to chronicle owing to Treasury restrictions as to the issue of capital, and the munitions work of gas plant contractors, there has been a considerable amount of attention paid to matters affecting the works, of which there can only be the faintest indication here. In the first place, it should be mentioned that an application was made to the Ministry of Munitions for the issue of a general certificate classifying orders for the manufacture and repair of gas plant and appliances, either on an equality with war work,

or as necessary for the efficient conduct of the war; and a reply was received to the effect that details of orders relative to gas-works should be sent to the gas section of the Department of Explosives Supplies, where instructions would be issued enabling such orders to be graded. It was ascertained that gas-works plant could be classified in "A" and "B" sections. A large amount of attention has been given in this country to the question of refractory materials. The Government and manufacturers generally have recognized the importance to the industries of thorough research into this matter; and the awakened interest was seen at the recent conference of the Faraday Society, where co-operation and co-ordination of research were strongly advocated. It is hoped that some step to this end will be taken. As was seen in the "JOURNAL" last week, an Association of Manufacturers of Refractory Materials has just been formed. The Institution of Gas Engineers obtained a grant from the Privy Council Committee for Scientific and Industrial Research in aid of the research being conducted by them into the question on behalf of the gas industry. America is busy in the same direction. Professor J. W. Cobb, Livesey Professor at Leeds University, threw further light on the subject of the effect of salty coals on refractory materials.

Many contributions bearing upon the working of gas-works plant appeared in our columns during the year. Horizontal retorts with machine charging—Widnes and Southampton may be taken as examples—defended themselves on the score of general working economy. Vertical retorts did the same; and an interesting contribution was that of Mr. G. C. Pearson, of Birmingham, to the vexed question as to the wear and tear of continuous verticals. Of good report is the working of the ovens at the Darwen Gas-Works. There were several articles showing that American gas practitioners are paying greater attention now than for a long past to coal carbonization plant, while carburetted water gas appears to be receding somewhat in favour. As shown in a recent editorial article, we may shortly expect some interest regarding new American retort-house practices, among which is the single ascension-pipe common to a number of retorts. A series of articles by Mr. Norton H. Humphrys on "Thermal Problems for Gas Engineers," and articles by Mr. H. C. Widlake on "The Evolution of Modern Charging and Discharging Machinery" and on the "Application of Electricity to Exhauster Driving" were features specially referring to works topics. Purification questions were very much to the fore; one of main interest being Mr. W. S. Curphey's statement, in the annual alkali report, as to difficulties that had been experienced in gas-purifier working where—not in all, but in some cases—the direct sulphate of ammonia system had been put in operation. The gasholder has been almost neglected this year in the contributions to technical literature. The spheroidal holder tank has been the subject of an article by Mr. R. J. Milbourne; but Waycross (Georgia, U.S.A.) suggests that gasholders should now be dispensed with, in view of the calorific power of gas being the dominating quality, and therefore high pressures can be applied. Its preaching is found in its practice. It has only six high-pressure storage tanks of a capacity of 10,000 cubic feet each; and the gas is compressed by an Ingersoll-Rand compressor.

There is nothing much to be said regarding work appertaining to the distribution system. In association with it, there was the first report, composed of a comprehensive investigation by Dr. Lessing, on gas-meter deterioration presented to the Institution of Gas Engineers; and another valuable contribution to the same subject was made by the South Metropolitan Gas Company.

TECHNICAL ORGANIZATIONS—EDUCATIONAL WORK.

The proceedings of the various technical organizations were throughout the year largely affected by the war. In some cases only formal business was transacted at the meetings of members, and no technical work was taken in hand. In others, where ordinary meetings were held, the addresses, papers, and discussions turned chiefly on questions touching work for war purposes, and on the effects of the war upon normal conditions. The Institution of Gas Engineers held its meeting in June. It was a one-day function. A brief Presidential Address from Mr. John Young was confined to current topics. The report already referred to of the Joint Committee (the Institution and the Society of British Gas Industries) on Meters, the report of the Committee on Refractory Materials, and that of the Joint Committee of the Institution and the Leeds University on Ventilation Research, were the principal other items. During the year, the Council of the Institution and the now ex-President (Mr. Young) and the new President (Mr. A. E. Broadberry) devoted themselves, with great energy and personal sacrifice, to the interests of the industry. Mr. Samuel Glover and Mr. Thomas Berridge are respectively now the Senior and Junior Vice-Presidents of the Institution. The District and Junior Gas Associations were variously active, though naturally not up to the standard of peace times, largely through the claims of the official duties of the members. To the organizations abroad, the same remarks will apply, excepting in America and other neutral countries where the work of the technical organizations was not in any way interrupted. The Society of British Gas Industries held useful meetings, with the Chairman (Mr. H. M. Thornton) presiding—the President (the Right Hon. H. E. Duke, K.C.) attending to the extent that his parliamentary and official duties permitted. The Coke-Oven Managers' Association has also been busy; and sectional societies have now been formed. The Illuminating Engineering Society, though not able to maintain pre-war activity, nevertheless succeeded in imparting a good deal of interest to its proceedings. Before the Institution of Mechanical Engineers, Mr. Harry E. Jones delivered the "Thomas Hawksley Lecture." An enormous amount of work was done at the annual meeting of the Society of Chemical Industry, with Mr. Charles Carpenter, D.Sc., presiding. In his address he dealt with the alliance of science and industry, and pointed to the absolute necessity for a cultured industrialism.

Regarding educational work, here again the war has made large impression. For example, Professor J. W. Cobb, Livesey Professor at the Leeds University, found the Coal Gas and Fuel Department almost denuded of students. But he and those assistants and students remaining to him have not been idle, but have been devoting themselves to testing and other work for the Ministry of Munitions, at the same time keeping research work on the move. Concerning the City and Guilds of London Institute gas examinations, the authorities decided, in the present state of affairs and with a short-handed staff, not to issue lists of successful candidates, and so we were compelled to compile a list by the aid of our friends and correspondence. The Examiners made criticism of the want of thorough preparedness of many of the candidates who presented themselves for examination. At the beginning of the year, the Education Committee of the London County Council published a valuable report, containing many suggestions, by Mr. A. Schwartz and Mr. James W. Helps, as to technical instruction in the gas industry.

IN PARLIAMENT.

In the course of this retrospect, several references have been made to various matters which have occupied the attention of Parliament, and which affect the interests of the gas industry—more particularly coal, sulphate of ammonia, and the calorific power standard. There is no occasion to repeat here what has been already said. As to the Private Gas Acts passed, there were comparatively few, owing to the prevailing conditions; and there will be still fewer in the ensuing session. The foremost question discussed had relation to the current financial position as to capital issues by gas company undertakings; and several concerns asked for power to create redeemable stocks. Particular mention in this regard may be made of the measures promoted by the South Metropolitan, the Newcastle, the Plymouth, the Colchester, the Aberdare and Aberaman, and the Imperial Continental Companies. It was only on Sept. 12 (p. 489) that review was made of the financial provisions of the Acts which owe their birth to the state of things created by the war and high interest-bearing Government loans, and to that review readers are now referred. In the succeeding issue (p. 549), other legislative developments were notified; and to what was then said, we must also refer readers—the chief interest being found in the tar-distillation proposals of the Plymouth and Stonehouse Company, calorific power standards, and minimum pressures. We cannot, in touching upon the parliamentary work of the session, omit reference to the deep sorrow of those whose work takes them to the Committee-rooms at the death of Sir Corbet Woodall, who had there earned for himself the high esteem and confidence of Committees, Counsel, Parliamentary Agents, and professional colleagues. The retirement from the Parlia-

mentary Bar of Mr. J. H. Balfour Browne, K.C., was also an event, regretted by all, but all were pleased that health remains for the enjoyment of a well-earned leisure.

Legal Cases.

In our "Legal Intelligence," numerous cases dealing with a considerable range of matters have been reported this year. To merely give an indication of their varied nature would occupy too much space. Outstanding is the Leiston public lighting case, which raised the question as to the liability of the local authority for the payment of the contract price for street lighting, during the continuance of the restrictions imposed by the military authorities under the Defence of the Realm Act. The Company offered to make an allowance for the gas unconsumed; and the result of the litigation, before Mr. Justice Low and the Appeal Court, was that the District Council were ordered to pay the contract price, as well as costs. Another interesting case was one in which the Edinburgh and Leith Gas Commissioners were concerned. They appealed against a decision of the Lands Valuation Court in fixing the yearly value of their undertaking at £76,932, which they contended should be £72,190—the difference representing income-tax payable on the profits of the undertaking. The Commissioners argued that they were entitled to a deduction of income-tax as an expenditure incurred by them in carrying on the undertaking. The result of the appeal was disagreement with the Commissioners, and the upholding of the view of the Assessors. Other cases referred to included gas accounts, gas poisoning, compensation claims, the absenting of an employee from work, water-gas patents, light from gas-works, sewers blocked by pitch, breaches of contracts, a prepayment meter agreement, the misuse of the names of certain Directors of the Travancore Minerals Company, the Walton-on-Thames embezzlement case was again heard of, and an embankment fire at Blyth caused by heat from a retort-house was also the subject of litigation. There were other questions adjudicated upon; but here we must leave them.

In the Money Market.

There has been during the year a cheerful response by the public to the demands for money for financing the war. In the early part of the year, business on the Stock Exchange in the 4½ per cent. War Loan was active; and 5 per cent. Exchequer Bonds and the Treasury Bills were much in favour. But, later, a formidable competitor came in the shape of the 6 per cent. Exchequer (three-year term) bonds, which knocked the bottom out of the market for other gilt-edged securities; and the rate of interest made the financial position worse for enterprises wanting money and with Treasury authority for raising it. The conditions of the issue of these bonds were much criticized by financial experts. Some impetus was given to dealings in 4½ per cent. War Loan by the announcement of the Chancellor of the Exchequer that it would be accepted at face-value from subscribers to the next War Loan. Early in the year minimum prices were removed from many securities, and later they were entirely abolished. This enabled us to include in our Stock Market list current prices in comparison with pre-war prices at July 30, 1914. From the figures, it is seen how considerable have been the reductions all along the line owing to the much higher costs of working, and, in the case of the home sliding-scale companies, the reduced dividends necessited by increased gas prices. Some of the concerns operating abroad have been especially hard-hit. Imperial Continental stock stands at less than half what it did before the war; the German Government proposals for the liquidation of the Berlin works of the Association did no good to the value of the stock. Continental Union stock also stands at about half its pre-war value; and Ottoman shares at about one-third. Primitiva ordinary has suffered severely, owing to misfortune produced by the war, and the continued neglect of the Municipality to discharge their long overdue public lighting accounts. There has been a fair amount of activity in gas share dealings during the year, owing to people with confidence in the future of the gas industry taking the opportunity of picking-up stocks at the low prices. The movement of prices, however, since January has not been notable, either up or down. In making comparisons with pre-war prices, it will be remarked that the Brentford and Liverpool stocks have meantime been consolidated and converted. The increase of income-tax to 5s. on unearned income, with allowances to those whose incomes do not exceed £2000, was regarded very unfavourably; and it gave rise to a tendency to more investors looking out for securities which are paid tax free. The Bank rate, which had stood at 5 per cent. since Aug. 8, 1914, was raised to 6 per cent. on July 13.

Personal and Obituary.

The personal notes published in the "Journal" have been throughout the year alive with interest—in some respects toned by pleasure, in others by sadness. Many of the younger men of the industry have gained proud distinctions for valour on the battle field, many have laid down their lives in the causes of national defence and honour, several have suffered wounds more or less serious. Official changes have been numerous, so much so that we must leave the record as published from time to time, with two or three exceptions. Mr. D. Milne Watson, the General Manager of the Gas Light and Coke Company, has been elevated to the position of Managing-Director; and on the retirement, through ill-health, of Mr. Henry Rayner, Mr. W. Beckford Long has been appointed Secretary of the Company. Mr. G. M. Gill, at the beginning of the year, entered upon his work as Chief Engineer of the South Metropolitan Gas Company. There have been a number of resignations. Mr. William Belton resigned the managership of the Shrewsbury Gas Company—retaining the positions of Engineer and Secretary. Mr. James Braddock retired from his long occupied office in the Radcliffe and Pilkington Gas Company, but is retained as consultant. Mr. J. S. Cranmer relinquished his appointment at Stratford-on-Avon, and became consulting manager. Mr. James Eldridge severed his connection with the Oxford Gas Company as its Engineer and Manager. Mr. T. O. Paterson resigned from the Birkenhead gas undertaking—continuing his association with it as consulting engineer. The same official severance and continuation of services as consultant has occurred between Mr. David Terrace and the Middlesbrough undertaking, and Mr. Thomas Wilson and the Coatbridge Gas Company. Mr. James W. Glover resigned the Managing-Directorship of George Glover and Co., Limited (Richmond Gas Stove and Meter Company).

The shadow of Death has frequently passed over the industry during the year; and men identified with it as officers, directors, and in trade have gone from us. Leader, worker, and friend of the industry, an irreparable loss was suffered by the death of Sir Corbet Woodall, D.Sc.; and one of the stalwarts in the professional ranks who was prematurely removed is Mr. J. G. Newbigging. From those whose names have had place for long years in the professional records, there have been taken Mr. William King and Mr. James L. Chapman. The men of the industry have mourned their and its losses by the gravesides of these and many other colleagues, and have sympathized with the friends of those who have heroically laid down their lives for country and for home.

At the Close.

This war marked and stained year is drawing to a close. The men of the gas industry can conscientiously say, or most of them can do so, that they have throughout its course been loyal to the interests of the country while serving to the best of their ability, under many hostile conditions, the interests of their undertakings. If there is more that can be done to aid the country then let it be done; for we all with full heart desire the great and awful bloodshed, loss of life, personal suffering, and devastation generally to be brought to as speedy a close as victory, honour, and an assurance of a lasting peace will allow. The dawn of peace means the dawn of fresh opportunities, and of the gradual return to settled, if not the old normal, conditions. Our prayer as we close the pages of the record of the year is: May the crowning victory of the Allies over the enemies of the peace of the world come during the days of the year into which we are entering with resolute purpose and aim.

Calorific Standard Application by Glasgow.

We are officially advised that the Secretary for Scotland has received from the Corporation of Glasgow an application for an Order under the Gas (Standard of Calorific Power) Act, 1916.

Greetings.

This issue of the "JOURNAL" will be received by readers too late to wish them all possible happiness during Christmas time. The days have not been ones for merry-making. We are living in times when all our thoughts and actions are, or should be, bound up with a common cause, and when the sharing of the sorrows of other people, from which in equal measure we may fortunately have been personally spared, have a deeper meaning than usual. However, where sad personal loss or other troubles have not intervened, we hope happiness has reigned during the Christmas season. There is also the future of which to think; and contemplating it, all hope to see on the horizon an early rising of brighter conditions, not only for this country, but for the whole world. Anyway, for the coming year, we sincerely tender to our readers all good wishes.

Debenzolizing Plant for Small Works.

One of the problems in the adoption of oil-washing on the smaller works has been to debenzolize the wash-oil. To send it a distance for the purpose is expensive both in carriage and in oil—in the latter owing to the delay caused in putting it into recirculation, and the extra quantity that has to be purchased owing to the delay, in order to ensure continuity in the washing process. Various suggestions have been made for meeting this difficulty, including the grouping of neighbouring works so as to economize in expense and time. In other columns, Mr. John Bond describes and illustrates an oil-debenzolizing plant (designed by him) which is in operation at the Southport Gas-Works. It is constructed of material that he had available on the works; and the labour involved in its erection only cost £25. The plant is of an extremely simple order; and if its components are not already in possession, the expense of procuring them cannot be heavy. The simplicity and the small amount of supervision called for are matters of importance to the smaller works; and this plant is distinctly suitable for such works, as it can be adopted where the annual carbonizing capacity is down to (say) 3000 tons. The President of the Midland Association (Mr. Charles H. Webb) singles this point out as an especially interesting one, in view of the fact that "it has hitherto been generally considered that a complete benzol extraction plant is only practicable for works carbonizing not less than 20,000 tons a year." Mr. Bond has been a hard worker in the high explosives cause; and he has left no stone unturned to increase supplies. There is a large field for this work among the smaller gas undertakings. It was not long since that the manager of a large benzol plant—not a gas-works manager—smiled at the interest taken in the gas industry over a small benzol-producing plant. Those responsible for the Explosives Supplies Department of the Ministry of Munitions do not smile over the smallest contributions. A large number of these become quantitatively highly important.

Weather Extremes.

The Board of Trade, under the old régime, urged that the use of gas and electric light should be reduced by an amount equal to 10 per cent. of the coal consumed in producing these illuminating agents. Big expenditure has been incurred in printing and posting large-type hoarding exhortations to the people not to waste coal, gas, and electricity. The intentions were good enough, but the suggested methods of effecting a little national economy (with the Government itself heavily wasteful in many ways) were—particularly in view of the impracticability beyond what had already been done—as useless as they were ludicrous. The authorities, too, did not take account of any possible tendency of the mercury receding towards zero, nor of Nature casting a heavy atmospheric pall over things, both of which would inevitably result in larger consumptions. There have been some notable extremes of weather recently. There have been days that have been freezing, days that have been dark the greater part of the twenty-four hours, and days that have been wet and raw. The conditions have been alternating in a capricious manner; and it has been weather during which, however previously strong had been the resolution of consumers to economize, necessity and personal comfort and health could not resist extra consumption of gas. We have not made any inquiries as to the output experiences of gas undertakings during the uncomfortable weather. Records can hardly have been beaten, with public and shop lighting brought down by authority to the irreducible minimum—"irreducible" unless authority insists on absolute darkness, and puts a complete stop to the country's outdoor activities save during the daylight hours.

A Gas Company's Mantle Offer.

Some particulars will be found in the news columns of this issue with regard to action which the Scarborough Gas Company are taking in the matter of the supply of incandescent mantles, &c., to consumers. To meet the circumstances which have arisen, Mr. A. Philip Allan (the Manager and Secretary) is determined to do all that is possible to secure the universal use of the incandescent system of lighting by customers of the Company. To this end, the offer has been made that upright or inverted incandescent burners, complete with mantle and globe, will be supplied and fixed free of charge in place of existing flat-flame burners, and, further, the Company are prepared to supply, and fit without charge, the best quality upright or inverted mantles at 1d. each. Consumers may fit the mantles themselves; but there is a reservation which it has, for reasons that will be appreciated, been felt necessary to make in connection with those sold under certain conditions. This enterprise on the part of the Company is naturally popular with the consumers, in whose interests the scheme has been evolved.

Borrowing Powers of Public Authorities.

One of the early steps taken by the new Ministry has for its object the easing of the position of local authorities in the matter of borrowing. To this end a Bill was introduced, and passed through all its stages in the House of Commons last Wednesday—being as expeditiously dealt with by the Lords next day—to enable county, municipal, and urban district councils, and other bodies, during the continuance of the war and for a period of six months thereafter, with the consent of the Government, and subject to such conditions as may be imposed, to raise money by "the issue of bearer bonds or other securities to bearer, whether within or without the United Kingdom, and, if thought fit, in any foreign currency." The limit of six months referred to will not apply to re-borrowing for the purpose of paying off loans under the Bill. In moving the second reading of the Bill, Mr. Hayes Fisher (the Parliamentary Secretary to the Local Government Board) pointed out that local authorities will still have to obtain Government sanction before incurring capital expenditure; but it is hoped that money will be raised in the United States and elsewhere, even though none of it can be spent until sanction is given. This hope will be shared by those who read Mr. Hayes Fisher's declaration that, if our great municipalities find favour among American investors, "it will help the exchange, and will help the Government in carrying on the war."

A Wrong Economic Turning.

In connection with the iron trade, Sir Hugh Bell has well-deserved eminence; but he has some notions on economic problems that do not universally appeal as sound. A nation's prosperity is not derived from one thing; it is the product of a number of almost countless enterprises—large to small. If a country began rejecting contributors to its prosperity because they were small, it would be the beginning of destruction, or the decline in the rate of progress. Sir Hugh Bell appears to consider it rather humorous that so much "noise" should have been made about the dye industry, its appropriation by Germany, and the attempts to regain it for this country. This was in an address before the Scottish Society of Economists; and members must have entertained some amount of pity for one who harboured the economic heresy regarding relatively small things to which he gave satirical voice. Sir Hugh says that "it comes as a shock to be told that the total value of coal tar dyes and dye-stuffs imported into this country in 1913 amounted to only £1,892,055. From all the clamour about it, it might have been one of the staples of German trade, and a great proportion of our own. It is, in fact, less than 2½ per cent. of German imports into Great Britain, and does not constitute one seven hundred and fiftieth part of the total foreign trade of the Kingdom." If the war brings the dye industry to this country on reasonable economic conditions, Sir Hugh would welcome it; but he would not alter by one jot or tittle our fiscal policy if, by so doing, the Badische

Company would never make another ounce of some polysyllabic compound. It is all very well Sir Hugh treating contemptuously the imported value of the dyes. On those dyes vast industries have dependence—industries which have an important part in the economic position of this country. Although it ought not to do so to a great manufacturer, it may appear paradoxical to Sir Hugh, but it is nevertheless a fact, that "trifles" have often an immense importance upon the final result.

Coal and Shipping Control.

It has been amusing to watch the colliery and shipping share markets since the promise of the new Prime Minister to the Parliamentary Labour Party, that the two industries should be brought under Government control during the remaining period of the war. Shares dropped considerably; and then there was a rally on a more optimistic view being taken that the promise was not one that was intended to be carried through with a thoroughness that would do any appreciable harm to profit-making. Then came the appointment of a Shipping Controller; and nervousness again set in, as this showed that Mr. Lloyd George was very much in earnest. But when it was appreciated that the Shipping Controller was himself a shipowner, heart was once more given to the market. The same in regard to coal shares when it was found that Lord Rhondda was to be a member of the new Government. When, however, the Prime Minister subsequently put the control of the shipping and coal industries as elements in the considered policy of the new Government, the two markets again became seriously affected by the prospects of drastic limitations of war profits. Selling became very persistent; and the high prices to which shares had ascended soon lost their splendour. But still some doubt exists as to the full intentions of the Government in regard to regulation. All this is a beautiful comment on the former protestations of the injured coal and shipping owners, that they were not making any undue profit out of war conditions. A strange thing has come to pass in another direction. The Miners' Federation have for some years advocated the nationalization of the coal industry; and though at first it appeared that the Parliamentary Labour Party considered that Government control during the war would supply the thin end of the wedge to the consummation of this great but impolitic aspiration, it was subsequently learned that the Miners' Federation feared that the present scheme would hinder rather than promote the realization of nationalization. The Executive Committee therefore asked the Prime Minister to grant them an interview before any definite action was taken. The short answer to the Miners' Federation would be that, "We are at war; and what is advisable now in the interests of the country might not be advisable in other circumstances." A good many political notions have had to sink before the claims and needs of war. However, although the Federation resolution was only passed on Wednesday evening, the following afternoon the Prime Minister gave an interview to a deputation, and assured them that State control in effect meant control of the coal output at the pithead, and that there was nothing to worry about so far as the miners were concerned.

Gas for Heating Japanning Ovens.

In order to compare the working of gas and electric japanning ovens, the Detroit City Gas Company built a number of gas-ovens operated under exactly the same conditions as some experimental electric ovens. Describing the results to the Michigan Gas Association, Mr. H. T. Hood said it had been found that, under the most favourable conditions for efficiency, where a low temperature is maintained for a long time, 85 per cent. of the gross heat of the gas is transmitted into the oven, and under the most unfavourable conditions, where a high temperature is required quickly, and then the oven is cooled at once so as to loose the heat stored up in the combustion boxes, at least 65 per cent. of the heat is transmitted into the oven. Or with a 600 B.Th.U. gas, 6½ to 8½ cubic feet are equivalent to 1 K.W. hour; and in general they are more than safe in figuring 8 cubic feet per K.W. hour. If one has a gas installation, and wishes to find out how much it would cost to use electricity under the same conditions, one can simply divide the cubic feet of gas used by eight, to find the number of K.W. hours necessary to do the same work. Knowing the cost of gas and the cost of electricity in any particular case, the comparison may be found. Under the most favourable conditions, the operating cost of an electric oven is at least twice that of gas in any place in Detroit; and under less favourable conditions, the cost may be four or five times that of gas per bake.

OBITUARY.

JAMES LAWRENCE CHAPMAN.

The closing days of this year have brought with them another sorrow; the ranks of the older members of the gas profession having been still further thinned by the death of Mr. James Lawrence Chapman, M.Inst.C.E., the Engineer and Secretary of the Harrow and Stanmore Gas Company. He passed away at his residence, "Collingwood," Royston Park, Pinner, last Tuesday morning, following upon an operation. For some weeks past he had not been in quite his usual health, but continued to attend to his duties almost until the end.

Mr. Chapman, who was seventy years of age, and was as well known as he was respected in the gas profession, was the son of the late Mr. John Chapman, who originally introduced gas at Harrow, and owned the works there. He was educated at King's College, London, and in 1864 was articled to Mr. W. M. Brydone, then Chief Engineer to the Great Northern Railway Company. Four years later he was engaged as Resident Engineer in connection with the construction of the Stamford and Wansford Railway; and in 1869 he joined his father in the management of the Harrow Gas-Works. These works were in 1872 sold to a Company; and Mr. J. L. Chapman was appointed Engineer and Secretary—a position which he thus held for the long period of 44 years, working hard, and always taking the keenest interest in the welfare of those under him. The Company is one of those which have adopted co-partnership principles; and in all respects the undertaking has, under his capable management, been kept well up to the most modern ideas. This will be readily admitted by those who know the works over which he had control. The Company obtained their first Act in 1873; and they have on three occasions since then been in Parliament—the last time in 1913. From small beginnings, the business of the Company has continued to grow in a manner which reflects much credit on the administration; and the major portion of this credit without doubt belongs to our late friend.

He was one of the founders of the Southern District Association of Gas Engineers and Managers, with which he actively concerned himself from the start. He was present at the original meeting at the Richmond Gas-Works in 1875, and became the first Hon. Secretary, retaining the position until 1887, when he was succeeded by Mr. James W. Helps. In the following year, Mr. Chapman took the Presidential chair of the Association; and ever since that time he has audited the accounts. He joined the British Association of Gas Managers in 1874, serving on the Council in 1887. Then he became associated with the new Institution; and after the amalgamation of the two bodies, he was elected to the Council of the Institution of Gas Engineers, for which he fulfilled the duties of Hon. Auditor.

The work already mentioned did not by any means suffice to absorb the whole of Mr. Chapman's energies; for he was a very useful member of the Boards of the Barnet District Gas and Water Company and of the Tuscan Gas Company, while he was recently appointed Chairman of the Hemel Hempstead Gas Company He also acted as Auditor to the Tottenham District Light, Heat, and Power Company and the Riddings Gas Company.

Major CECIL COLSON, M.C., R.G.A., who was killed in action on the 14th inst., was the son of the late Mr. Alfred Colson, the Engineer of the Leicester Corporation Gas Department. When, some months ago, the Military Cross was conferred upon him for gallantry and devotion to duty in the field, it was stated that, as forward observation officer, he displayed on three occasions an utter disregard of danger under heavy shell fire.

The funeral of Mr. WILLIAM KING took place last Tuesday; a service at St. John's Church, Waterloo, being followed by cremation of the remains at Anfield Crematorium. The cortege was preceded to the church by a squad of county police, Mr. King having been a County Magistrate. Among those attending were Mr. H. Wade Deacon, J.P., the Chairman of the Liverpool Gas Company, and the following officers: Mr. Theodore Garnett (Secretary), Mr. R. E. Gibson (Engineer), Mr. Edwin Upton (Treasurer), Mr. E. Astbury (Assistant Engineer), Mr. T. N. Godden (Superintendent of the Linacre works), Mr. J. Charnley (Superintendent of the Wavertree works), and Mr. J. M. Dow (from the Engineer's Office).

We much regret to learn, from the December issue of "Het Gas," of the death on the 5th of November of Heer WILHELM K. N. GEERLING, who had since August, 1906, been Engineer of the East Gas-Works at Amsterdam. Born at The Hague on May 29, 1869, he passed away, after a long illness, in the prime of life. His first association with the gas industry was when he became a clerk at the Hague Gas-Works in 1887. Studying in his leisure the technical side of the industry, he was in 1892 appointed Superintendent at the Groningen Gas-Works, and in 1895 Manager of the Almelo Gas-Works. In 1898, he entered the service of the Amsterdam Corporation, as Assistant-Engineer at the East Gas-Works, under Heer J. van Rossum du Chattel; and in 1906, when the latter was transferred to the West Gas-Works, Heer Geerling succeeded him as Managing Engineer at the East Works. Heer Geerling took an active part in the work of the Dutch Gas Association; and his loss is deeply felt by all his colleagues in the industry.

PERSONAL.

Mr. A. G. Bradshaw, Engineer and Manager to the Lancaster Water-Works, having been requested to accept a Commission in the Royal Engineers for road-making purposes in France, the Corporation have appointed Mr. F. Hill, Chief Assistant, to carry on his duties in his absence.

It is understood that nothing has yet been decided with regard to the filling of the vacancy caused by the death of Mr. J. G. Newbigging, the late Chief Engineer to the Manchester Corporation Gas Department; and possibly a considerable time may elapse before steps to do so are taken. No doubt, in the meantime, if it should be found necessary to do so, the Committee will avail themselves of some temporary professional assistance.

Mr. Stuartson C. Methven (who is over forty years of age), the second son of the late Mr. John Methven, and brother of Mr. J. H. Methven, Engineer in charge of the Kensal Green Station of the Gas Light and Coke Company, has recently come over with Australian reinforcements. Mr. Methven has for some years been in Government service in Fiji, and recentiy received leave to join-up. Mr. T. G. S. Hersey (who is over 46 years of age), the son of Mr. T. C. Hersey, late Distributing Engineer to the Gas Light and Coke Company, came over with a Canadian contingent, and is now in France. Mr. S. C. Hersey, the only son of Mr. Sidney Hersey, of Messrs. Kirkham, Hulett, and Chandler, Limited, was in France with the R.M.A. Anti-Aircraft Brigade, and has been invalided-out. Mr. Sidney Hersey has five nephews in the service—the two mentioned above, two being sons of his brother George who have been eighteen months in France, and one at Salonica.

NATIONAL GAS COUNCIL OF GREAT BRITAIN AND IRELAND.

De-Badging of Gas-Workers.

The circular-letter (M.M. 100) recently issued by the Ministry of Munitions as to the de-badging of unskilled and semi-skilled men, has naturally caused considerable anxiety among gas managers already struggling with serious difficulties arising from shortage of labour. The proposed de-badging, if it led to further material depletion of gas-works labour, would seriously affect the gas industry; and the matter is accordingly receiving the immediate attention of the Council, who propose to communicate with the authorities concerned without delay.

Calorific Power Applications and Minimum Pressure.

Representatives of the Council attended a conference convened by the Board of Trade on Monday of last week, at which the Local Government Board and the Scottish Office were represented, with reference to an application by the principal railway companies that in Orders made under the Gas (Standard of Calorific Power) Act, 1916, the statutory penal minimum pressure should be fixed at 20-10ths, instead of at 15-10ths as in the Sheffield Order. The objections to this proposal from the point of view of the gas industry were strongly urged at the conference by the representatives of the Council, and were subsequently embodied in a memorandum to the Board of Trade. The Chairman reserved his decision, which has since been communicated, and is to the effect that the minimum pressure will be fixed at 15-10ths in all Orders, subject to revision after five years, as already provided for in the case of the calorific power.

ELECTRICITY SUPPLY MEMORANDA.

Our friend Mr. F. D. Marshall has a competitor. Not long since he—"F. D. M.," not the competitor—presented to the country, to the surprise of electrical technologists, a scheme whereby electrical energy could be supplied in bulk at 0·062d. per unit. But electrical people are not satisfied with schemes on paper; they want actual demonstration. Mr. Marshall's scheme was a double-barrelled one.

Electrical Energy at One-Fiftieth Present Cost.

First coal was to be carbonized by a low-temperature process; and all the value to be obtained thereby was to be brought into account. Then the coke was to be gasified, under ammonia recovery conditions; and a large volume of gas was to be produced for use in internal combustion engines for the generation of the electrical energy. That was the scheme. Now an American mining engineer comes along; and he says he has a process up his sleeve whereby he can produce electricity at one-fiftieth of the present cost. Before a value can be assigned to the one-fiftieth, and before Mr. Marshall's 0·062d. can be considered to be out of the running, we must know what the American mining engineer takes as the "present cost." About the claims of this engineer there appears to be something almost supernatural; at any rate, they transcend anything that has ever come before us—even from America—in the electrical energy line for the ordinary purposes of life. In fact, they almost take one's breath away as the revolutionizing possibilities are unfolded and contemplated. If Mr. Marshall was going to give electrical energy to the world at a price that would enable it to be universally applied for light, heat, and power, and if the American mining engineer's "present cost" is that which is realized with modern steam turbines, then the gas industry must look to itself. It is stated that the world's electrical revolutionist is offering his invention in the first place to the British Government. In passing, we wonder just why he has come from America with it to be so generous over here; and why he has not offered it in the first place to the American Government. Perhaps he has; and perhaps their confidence is not so great as that of the American inventor.

Nitro-Energy.

The details of the scheme are, of course, not yet available. The American Mining Engineer has first to properly secure himself before revealing the wonderful secret, which he brings to the British nation as a Christmas surprise. All the information about it that has yet been seen was published in the "Observer" last Sunday week. The inventor proposes to use the nitrogen of the atmosphere as an energy producer. The new raids on atmospheric nitrogen are increasing. But he tells us there are in the atmosphere 4000 billion tons of nitrogen available for use for the new power. We have not checked the calculation; but it suggests itself as a figure that, after the new process is satisfied, will give a margin for the other purposes of mankind. But marvel comes upon marvel in connection with this new process. "Unlike the use of hydrocarbon fuels, which are destroyed, the new method of using nitro-power converts the fuel back into its elemental state." It can be used for every purpose for which coal and crude oils are now employed, even to smelting. With the apparatus, one ton of nitro-energy is equivalent to 1300 tons of coal; and it is safer than petrol. But that is not the whole of the romantic tale. The present electricity generating stations can all be dismantled. Five or six will in future suffice, with trunk mains radiating to all parts of the country; and the energy delivered by them will be ample to turn every wheel in the Kingdom, light and heat the homes of the people, and do all the cooking. By it—thank goodness!—the war can be brought to a speedy termination, without the Kaiser's peace plan. For war purposes, there is no reason why the apparatus should not be installed in any war vessel within the next three months. A submarine large enough to mount 6-inch guns could be driven round the world by this energy without refuelling. A battleship could keep the seas for a year without a new supply of fuel. Half a ton of nitro-energy would do the work of 600 tons of coal. By it aerial navigation to any part of the world would become easy. Although in the process (so says the inventor) temperatures are produced of over 8000° Fahr., that of the outside of the generators is the same as the surrounding atmosphere. This gentleman ought to be valuable to those who are searching for refractory materials capable of standing higher temperatures than those that are at present found to be admissible with known and practicable substances; and he should also be of considerable assistance to those manufacturers of electric-ovens who are trying to find a means of preventing the loss of dearly bought heat by radiation, convection, and conduction from their productions. Professor W. A. Bone should also get him on his Fuel Economy Committee, for the process, on the inventor's own valuation of its powers, provides the burial ground for all the fuel waste that at present abounds. Meantime, we are not disturbed, and shall await with a serene mind further information from this transformer in the world's work and needs of the means of providing light, heat, and power.

Water Power and Capital Costs.

Power production by the direct use of raw coal is gradually falling into the melting-pot; but we are not yet prepared to say that the nitro-energy scheme is going to hasten its liquefaction and final vaporization. Nor does water power seem likely to help in the process of dissipating the crude coal method. The low costs of producing electrical energy by this means have been proclaimed, and envious credence given to them the world over. But yet report has ventured to tell us that products—such as fertilizers—of which atmospheric nitrogen forms the base are produced in Germany by means of internal combustion engines at a lower cost than is the case in Norway with water power, owing to the heavy capital costs involved in the water-power system. Fuel or water energy does not constitute the whole of the expenses that must be taken into account in arriving at the cost of production. On a smaller scale, the same thing applies to the Diesel engine. The fuel cost per kilowatt-hour is not the only item to be considered in judging economy. In all electrical work, the capital charges are heavy; and this is especially so in relation to water power. "Meteor" of the "Electrical Times" produces an instance in referring to the hydro-electric system of the Swedish Government, which is used largely for railway electrification. The hydro-electric undertakings of the Royal Waterfalls Board represent a capital of nearly six millions sterling. Last year the gross receipts amounted to about a quarter of a million sterling; and the working expenses were only £83,000—the surplus being £173,000. But this surplus on the gigantic capital outlay means only 2·87 per cent., and this obviously without any allowance for depreciation and replacement. Considered apart from the internal conditions of Sweden in regard to fuel, this scheme does not commend itself for economic soundness. At present, it looks as though there is nothing

to do but to still adhere to coal for power supply, but coal used scientifically, and not charged in crude form into the furnaces under steam-boilers.

Diesel Troubles at Bath.

References are continually being made, where Diesel engines are employed for electricity-producing purposes, to the difficulties experienced with them, which have to be thrown into the balance against low fuel costs per unit generated. The Bath Corporation Electricity Department has had its troubles. The matter was referred to at a recent meeting of the City Council. One speaker stated that nearly £5000 had been spent on the engine and its accessories, and now a further £451 had been expended on repairs, though the Council had only voted £150. Another speaker averred that of the particular type of Diesel engine which the Bath one represents, there was only one other now in existence—at Oxford; and the others had all done some serious damage. There was some talk of calling in an expert; but this, apparently out of respect for the feelings of the Electrical Engineer (Mr. F. Teague), was not pressed. He was interrogated on certain points; and among the statements he made in reply was that, after running th irteen hours, the bearings of the engine were in absolutely as good condition as when it started. Is that anything wonderful? However, all that was done as the result of the discussion was to agree to obtain a report as to the cost of insuring the engine. It is clear that the Diesel has caused some amount of unhappiness at Bath.

Breakdowns and Public Safety.

Walsall has, like Birmingham, been suffering from overworked electricity plant; and during the past month, "several breakdowns" have occurred. The result is that consumers are asked to restrict their use of current as much as possible between the hours of 4 and 6 p.m.—just the time when falls in winter the heaviest demands for lighting. This is awkward. But it is not only where plant is being over-worked that there is fear of electrical collapses. The plurality of the seats of breakdown in an electrical system, together with uncomfortable experiences, undermine confidence. The Theatres and Music Halls Committee of the London County Council lack confidence in the constancy of electric lighting. They now have their eyes on the safety of the public in cinematograph halls; and so they desire in connection with the granting of licences that while the public are on the premises, both the primary and the secondary systems of lighting shall be fully maintained in all parts of the building accessible to the public with the exception of the hall. In the hall both systems are to be maintained.

Hackney and Preferential Charges.

The Hackney Borough Council (whose begging appeal for "maintenance" was noticed last week) are rather anticipating that their legal controversy with the Gas Light and Coke Company over the question of preferential charges is going to be carried through on a cheap scale. Their estimate is that their liability in this direction during the current financial year will be £500. They have not erred on the side of excess; but we do not know whether this includes carrying the matter into the Appeal Court and on to the House of Lords. If so, they will be very fortunate. Regarding the appeal to other authorities for financial support, or "maintenance," the hope is expressed by the Finance Committee of the Borough Council that "a good proportion of the costs will be borne jointly by the authorities who will benefit should the contentions of the Gas Light and Coke Company be unsuccessful." Suppose the Company are successful, as they have good hope of being, in view of precedent?

Higher Prices and the Need for Economy.

The Bognor District Council are animated by some peculiar ideas. Charges for electricity all over the country have, since the war started, been increased by from (say) 10 per cent. up to 40 per cent., but the administrative governors of Bognor think that the Gas and Electric Light Company are doing something that is positively wrong in increasing their charges, notwithstanding that costs have gone ramping-up all round in connection with the electrical business just as they have in every other business. The Council have protested to the Company and to the Board of Trade. The Board have informed the complainers that the Company are acting quite within their statutory rights; seeing that they are empowered to make a charge of 13s. 4d. for any amount of current up to 20 units, and 8d. per unit for every unit over. The Company very seriously considered the question of increasing the price before taking the step. No Company seeking to establish a paying electricity business would do otherwise. The conditions compelled—more particularly in view of the fact that the undertaking was being worked at a loss. The Council, however, were not to be appeased by the explanation of the Board of Trade; and so they have again written to the Whitehall authority emphasizing the very foolish view that "the Company are acting on a wrong basis in fixing the charge as they have done at the present time, when there is such need of economy." Are there any butchers, grocers, drapers, bakers, or other tradesmen on the Council who have followed the principle since the war began that it would be wholly wrong of them, though market prices have increased, to raise their own prices at the present time, when there is such need for economy? If the tradesmen councillors carried out the principle that they would like to see applied by the Gas and Electric Light Company, they would soon, especially if working at a loss, find themselves in the Bankruptcy Court. And they would deserve the fate.

SIXTY YEARS AGO.

From the "Journal" of December, 1856.

Purification by Oxide of Iron.—The trial of *Hills v. The London Gas Company*, for an alleged infringement of patent right in the use of oxide of iron for the purification of gas, has resulted in a nonsuit, under circumstances which clearly indicate that no patent right can, or does, exist for the employment of this oxide in the manufacture of gas. As it is not, however, our province to enter into a discussion of the legal arguments adduced on the above occasion, we content ourselves by calling attention to the facts brought forward in the evidence, which we publish in its proper place in our columns, and which, as will be seen, most singularly confirms the conclusions arrived at and published in the "JOURNAL" more than three years ago. Those conclusions, it will perhaps be remembered, ascribed to Mr. Croll the merit of having first suggested the use of oxide of iron in the purification of gas; while to Mr. F. J. Evans they awarded the remarkable discovery of what is now called revivification, or the process by which the oxide of iron can be used over and over again a great many times in succession, and to which alone we are indebted for the practical application of a system evidently destined to revolutionize the purification, not only of gas, but of sewerage airs and waters, and many other sulphuretted combinations.

By a reference to the evidence, it will be found that, so far back as the year 1840, Mr. Croll used the hydrated oxide of iron for the purification of a large portion of the gas manufactured at the Brick Lane station of the Chartered Gas Company; and we can now understand how it happened that Mr. Croll did not discover the revivifying process, as he appears to have carried the spent material to the upper part of the retort-beds, to be reconverted in a situation where the absence of light necessarily prevented him from observing the real nature of the action which ensued. Otherwise, as this is directly the reverse of that produced by heat, it could scarcely have failed to arrest his attention. Thus, the heat acting at the lowest part of the black mass of sulphuret of iron, ought to have made this red before the upper part; but the actual result, on the contrary, is that the upper part becomes red first, because this is the portion most exposed to the air, although, in Mr. Croll's case, the least exposed to the fire. We see, therefore, that had the attempt to reconvert the oxide by fire been made in open daylight, it would most likely have come within the observation of the first inventor that simple exposure to air alone was the only requisite. As matters now stand, the entire merit of revivification rests with Mr. Evans; and whether it be regarded in the light of a mere accident, or as the result of acute perception, conjoined to careful reasoning, is equally deserving the gratitude of the gas world. By its means, much of the absurd clamour about unwholesome gas and gas-works loses its force, as there is no smell for the nosey-nuisance hunters to sniff at; and, although the oxide of iron process unquestionably entails an additional outlay upon the manufacture of gas, yet this is but a small thing compared with the comfort of being freed from Lord Palmerston's *nose*ological bloodhounds.

It appears to us, however, that no trifling thanks are due to the London Gas Company for thus coming forward to defend a common right against pretensions which are proved to have been unfounded.

American Natural Gas.

The yield of natural gas in the United States, "Engineering" points out, shows at present no tendency to decline. In 1885 the production was valued at $4,837,200, in 1895 the corresponding total stood at $13,606,650, and in 1905 at $41,562,855. In ten years ended with 1914, inclusive, the annual value showed more steadiness and, at the same time, it exhibited a gradual tendency to increase, the yearly totals coming out as follows:

Year.	Value.	Year.	Value.
1905	$41,562,855	1910	$70,756,158
1906	46,873,932	1911	74,621,534
1907	54,222,399	1912	84,563,957
1908	54,640,374	1913	87,846,677
1909	63,206,941	1914	94,113,524

"Modern Gas-Works Practice."—We have received from Messrs. John Allan and Co., of No. 8, Bouverie Street, E.C., and shall be reviewing in due course, a copy of "Modern Gas-Works Practice," by Alwyne Meade, Assoc.M.Inst.C.E., Lecturer in Gas Engineering and Allied Subjects to the London County Council and at the Regent Street Polytechnic, and Manager of the Wapping works of the Commercial Gas Company, whose Engineer and General Manager (Mr. Stanley H. Jones, M.Inst.C.E.), has written a short introductory note. The eighteen chapters into which the book is divided (and nearly every one of which the author acknowledges has been submitted for suggestions to an expert in the particular branch with which it deals) extend to about 500 pages, with 350 illustrations. The price is 18s. net.

AMERICAN COMMERCIAL GAS ASSOCIATION.

RETURNING to the proceedings at the twelfth annual convention of the National Commercial Gas Association of America, which was held in Atlantic City (N.J.), attention may in the first place be drawn to the report of the Illumination Committee.

Dealing with the subject of "Hotel, Restaurant, Institution, and Club Gas Appliance Installations," Mr. G. M. Karshner, of the New York Consolidated Gas Company, remarked that various styles of ranges have been offered by different manufacturers as the best for any class of cooking. He has seen installations which have been giving satisfactory service to the customer for years, and which a good salesman would not instal for the kind of work being done. Salesmen should be very careful in selling ranges of new types having theoretical talking points, which appear much stronger than certain types that are giving satisfaction. Where, however, a salesman has control of the original installation, he should use the appliance which, in his opinion, is best adapted to the work contemplated. For hotel work, it has been his experience that a solid all-hot top range, with a red-hot spot, is the most satisfactory in New York City. In fact, with the main installation composed of part solid-top equipment and one or two sections of spot-burner type (depending upon the size of the gas installation), most hotels, restaurants, institutions, and clubs will receive the best service. There is a new type of hotel range on the market now which has the desirable features of the all-hot top, with a red-hot spot and a cooler part, and individual control of ovens, and at the same time permits the products of combustion from the top to be utilized, if desired, in heating the oven. In other words, the top may be utilized with the top burners, and only the top heated, when the oven is not in use; the oven can be used, and only the oven burners utilized, when the top is not in use; or both the top and the oven may be heated by utilizing only the top burners. Theoretically, this type of range should meet the general requirements better than any other type; but only experience on the district will demonstrate its practicability and economy in gas consumption.

In the opinion of Mr. Karshner, the most serious objection to a gas hotel range is its width. The cooks are accustomed to 48-inch coal-ranges; and when the gas company give them a 30 or a 34 inch gas-range section, they claim that their work is hampered. He anticipates the development in the very near future of a gas-range of 42 inches width, and believes that it will be the standard size in a few years. A 48-inch range he regards as too large, and a 34-inch too small. The next serious objection he finds to a gas-range is the depth of the oven. In his district coal-ranges are fitted with ovens 28 inches deep; and an oven which is 26 inches deep is too small. He declared that in New York a manufacturer who makes an oven 28 inches deep will have a big lead over his competitors.

The report of the Committee on Auxiliary Heating was prepared by the Chairman (Mr. George S. Barrows), who explained that it had been decided by the Committee that the most desirable form for the report to take would be a compilation of data on present gas-heating systems, for the purpose of rendering available specific information for the use of canvassers. Nothing more was contemplated than that a start would be made this year with collecting figures, in the hope that the work will be continued in succeeding years, until there are sufficient data available to make it possible for a canvasser in soliciting heating business to use a figure which will be a fair average. A number of tables were submitted, but without any attempt to reach a definite conclusion as to the relative merits of any of the various methods of gas heating, as the information offered, while true in its own particular case, might be subject to more or less variation when applied to another. The temperatures maintained, the tightness of the buildings, and the attention given to the heating plants are, of course, factors that necessarily enter largely into the efficiency of any system. Not knowing the exact conditions existing in any of the cases to which they refer, the Committee have proceeded on the assumption that all buildings of one kind were of like class of construction, that an average temperature of 70° was maintained in each case, and that a like amount of care and attention was given to all plants. The figures relative to gas consumption are set out by the Committee in terms of cubic feet of gas required per heating season per 100 cubic feet of building contents heated.

The Committee believe that there is a big opportunity for increased sales in connection with house-heating by artificial gas. Numerous consumers in moderate-sized houses already equipped with a coal central-heating plant, will welcome a gas-fired installation of ample size for the entire house in the severest weather, and will use such an installation as long as they can afford to. By reading the meter weekly, the householder is in a position to determine for himself whether he is willing to pay the higher cost of gas heating in return for the convenience, or will start the coal-furnace again, putting up with the annoyance to take advantage of the saving. The attempt to adapt gas-burners to existing coal-heaters can, they say, have but little commercial success, and will no doubt often prove costly to the gas company.

Recalling the benefit which incandescent lighting bestowed on the gas industry at a critical time, Mr. H. S. Christman, of Philadelphia, in a contribution on "Residence Burner Maintenance," said that, with the improvement in appliances and reduction in cost of electricity, gas undertakings are again face to face with the proposition of having to do something or gradually lose their residence lighting business. This "something" he regards as the proper maintenance of consumers' burners. Keeping consumers' lighting appliances in the best possible condition will, he argues, assist in securing three results for which all are striving. The first of these is a desire on the part of consumers to use the maximum amount of gas; secondly, a further desire on the part of consumers to instal additional appliances and use gas as far as possible in more up-to-date fixtures; thirdly, a less desire on their part to replace gas with a competitive product.

While admitting that no plan of maintenance will entirely prevent consumers from changing over to the use of another illuminant, he said that, with fixtures of modern design, and with a system of maintenance that gives satisfaction to consumers, any apathy which may exist towards gas as an illuminant will materially decrease. The maintenance of lamps and burners in an efficient working condition is generally conceded to be the best means of securing the desired results; and how to do this without excessive expense to the consumers, and at the same time without unreasonable cost to the company, is a question of the utmost importance. Having given the matter careful consideration, Mr. Christman is of opinion that a combination of the following three plans (which he described fully) would produce the best results: (1) Free house-to-house inspection, making three calls per year, including the sale of maintenance material at retail prices. (2) The contract plan—somewhat similar to the usual commercial maintenance. (3) Request maintenance.

Mr. W. A. Ehlers is Industrial Fuel Specialist to the Association; and he urged the need for a better appreciation on the part of a great many commercial managers of the importance of the scientific application of heat to industrial operations, and of the complex nature of problems which must necessarily be solved in order to design or specify equipment which will be adequate to meet the needs of the special work it may be required to do. Giving examples, he cited a case he had recently come across, in which a 3 H.P. boiler had previously been sold, installed, and removed because it did not do what was wanted; and a coal boiler had been bought and put in its place. An 8 H.P. boiler would have been the proper size to do the work satisfactorily; but the opportunity had been lost, in consequence of the poor service rendered on the part of the gas company in connection with the initial installation. In another instance, involving the consumption of upwards of a million cubic feet of gas per month, attempts were made by the gas company's salesman to place some atmospheric burners under very large lead pots, with nothing surrounding the burners, and no provision made for a well-insulated combustion chamber. When this was proved to be an utter failure, it was found almost impossible to take up the matter again with the factory management on other and more efficient lines.

Such conditions do not, however, exist everywhere; many companies working along progressive and practical lines, selling the proper equipment for the particular work it is intended to perform. If their methods are well looked into, it will, declared the author, no doubt be found that they have recognized the need for men of special training for this work. In the case of domestic equipment, there are two or three types of appliances which will meet the needs of almost every customer; while with industrial work almost every job is special, and thus needs individual analysis. It will also be found that the requirements of different cities for domestic equipment are virtually the same, and that for industrial work two processes, though fundamentally the same, will be widely different in their form of application of the fuel. All this demonstrates the necessity for having men of ability to work out the problems along purely scientific lines.

A plea for good quality merchandize was advanced in a paper submitted by the Manufacturers' Section, and read by Mr. W. W. Barnes. Knowing that the appreciation of quality outlasts the memory of price paid, let us, said the paper, all stand behind the manufacture and sale of better goods at better prices. This leaves the maker and seller with just as much money in hand as before, and the industry for which all are working gains the attention of the ultimate consumer, because of the better results achieved. Each year evidence of progress is seen in the perfection of new and meritorious devices for the use of gas for light, heat, and power; and the section feel that the gas fraternity should encourage manufacturers in the advancement of the art, rather than give support to the manufacturer who copies the ideas of others, and relies on a "price appeal" in order to get business. Their contention, in a few words, is that "the artist should be favoured, and not the artisan." Preference, it is also pointed out, should be given to manufacturers who support the National Commercial Gas Association, rather than "that class who profit by the duplication of ideas of those who believe in co-operation and the up-building of the product." The promotion of frankness, fairness, and business honesty between manager and manufacturer is what, in conclusion, is asked for.

It is estimated (says "Engineer") by Dr. Thomas H. Norton, of the U.S. Bureau of Commerce, that the American production of benzol during 1916 will be 120,000 tons; toluol, 32,000 tons; refined naphthalene, 100,000 tons. In a bulletin published by the Bureau of Commerce, showing the production of these products in November, 1915, the approximate monthly production at that time was 7500 tons of benzol, 1850 tons of toluol, and 1000 tons of naphthalene.

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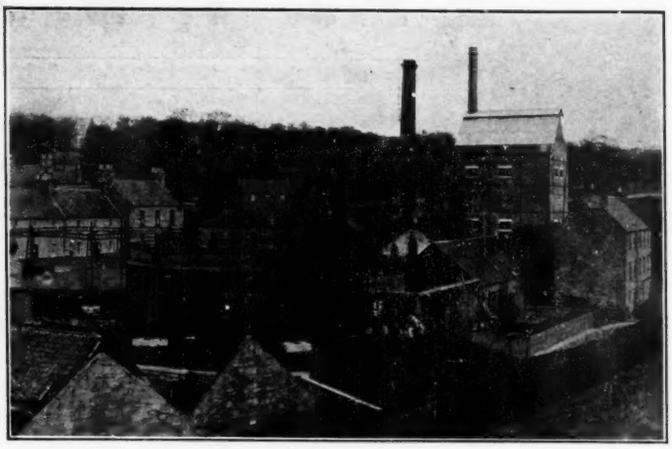

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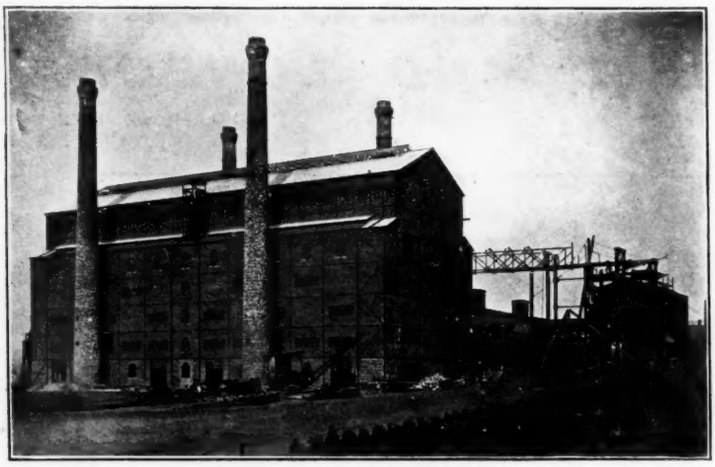

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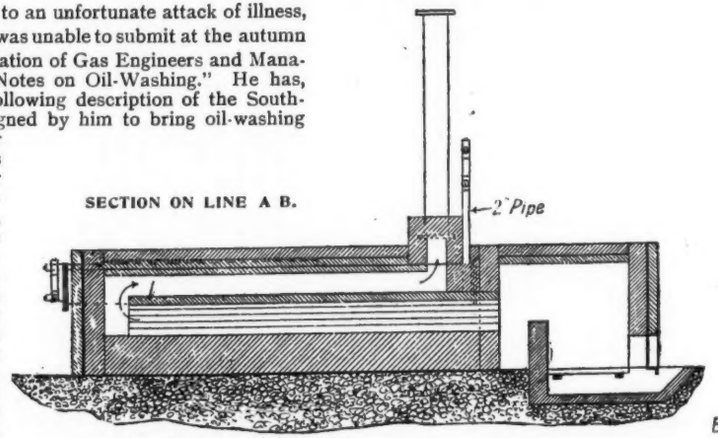
THE SOUTHPORT DEBENZOLIZING PLANT.

Mr. John Bond's Description for the Midland Association of Gas Engineers and Managers.

IT will be recalled that, owing to an unfortunate attack of illness, Mr. John Bond, of Southport, was unable to submit at the autumn meeting of the Midland Association of Gas Engineers and Managers his promised "Further Notes on Oil-Washing." He has, however, now prepared the following description of the Southport debenzolizing plant, designed by him to bring oil-washing within the scope of smaller works, carbonizing not less than 3000 tons of coal per annum. This has been circulated among the members, along with a letter from the President (Mr. Charles H. Webb, of Stourbridge), remarking that it has hitherto been generally considered that a complete benzol extraction plant is only practicable for works carbonizing not less than 20,000 tons a year. The attention of engineers of smaller works than this is therefore called to Mr. Bond's plant, in the hope that wherever possible the process will be adopted by them.



The illustration shows the Southport debenzolizing plant, which has been erected from material found on the Southport Gas Estate. Similar material is usually found on most gas undertakings, or can be readily procured at small cost. The whole of the plant was erected in ten days' time, at a cost of £25 (labour only). The plant has been working for some considerable period, and has given entire satisfaction. The sketch indicates the simplicity of the apparatus; and apart from the small amount of labour required on the furnace, very little supervision is necessary.

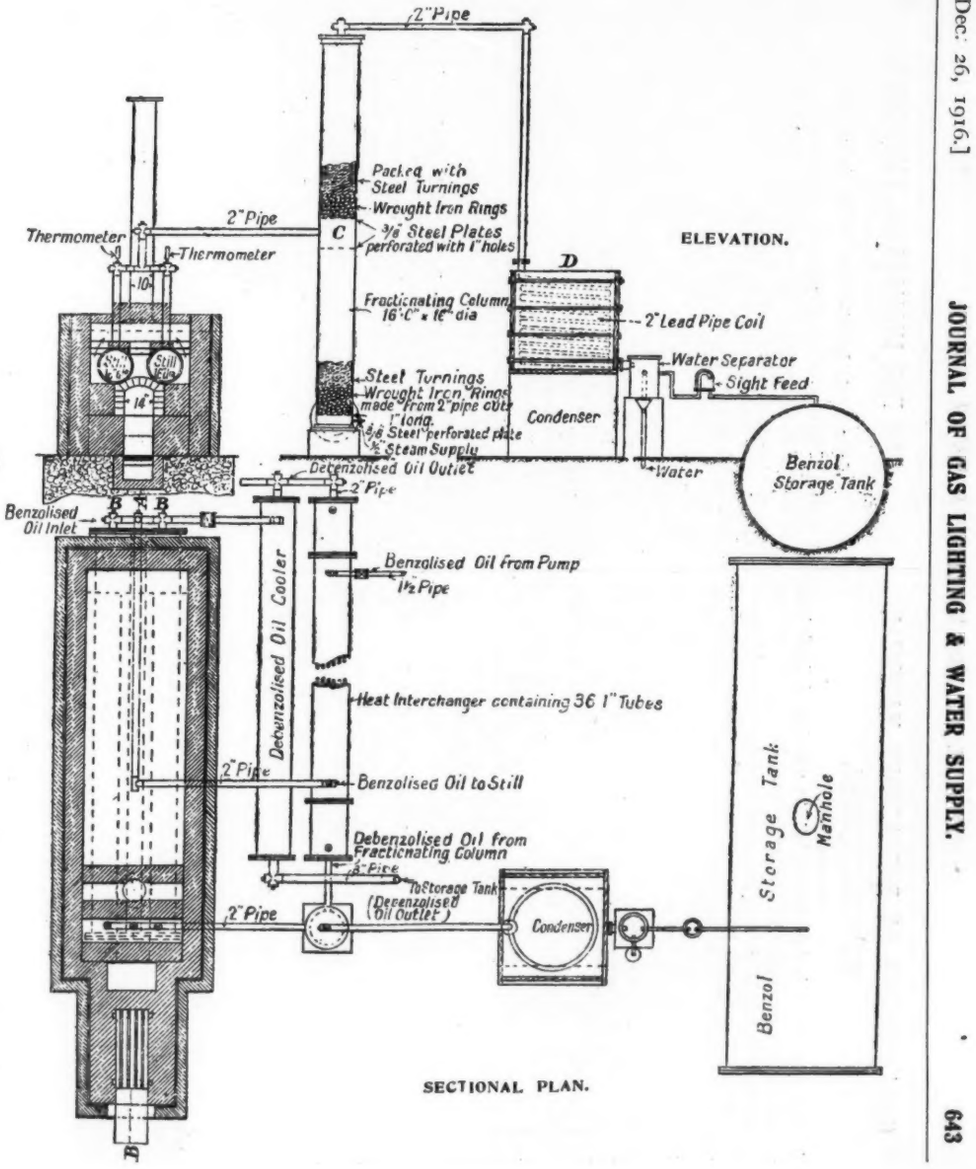
The benzolized oil is continuously pumped into an overhead syphon, which is fitted with an overflow. By the adjustment of a cock marked A on the plan, a regular supply of oil is maintained. The benzolized oil passes through a heat-exchanger, and enters at the bottom of the twin heating tubes at B. Connected to the inlet-pipe, there is an extension-pipe to the debenzolized oil cooler, which pipe is fitted with a cock, so that at any time the oil can be drained-out of the heating tubes, the end flanges removed, and the tubes cleaned when necessary.

The oil passes out of the 16-inch heating tubes by means of two 2-inch pipes, at the top of which are mounted thermometers. These thermometers are fixed into the top plugs, and made tight by cement. The tubes are connected to the chamber C in the middle of the fractionating column. The benzolized oil, which is heated to a temperature of between 110° and 120° C., passes into the lower portion of the fractionating column, through a quantity of steel turnings and rings, as shown on the plan. At the base of the column there is a small chamber, into which a volume of steam is passed. The steam meets the hot oil as it passes through the mass of turnings and rings. The upper portion of the column is filled in a similar manner to the lower portion.

By a proper adjustment of the steam, a 65 per cent. benzol can readily be obtained from the benzolized oil. It is possible to obtain as high as 80 per cent. benzol; but if this quality is maintained, a certain amount of benzol returns with the oil to the storage tank. The benzol condenser D is made from 2-inch lead pipe, and attached to a small syphon-pot at the lower end, in which separation of the water from the benzol is effected.

In the working of the Southport plant, the steam is so regulated that the condensed water coming along with the benzol is equal in volume to the crude benzol. The plant is capable of debenzolizing 250 gallons of benzolized oil per hour, and the maximum amount of 264 gallons of 65 per cent. benzol may be recovered in one day.

Should any engineer seriously consider adopting this plant, and require further particulars with respect to it, he will be able to secure the information from Mr. Bond, at the Southport Gas-Works, where the plant can be seen working, by appointment.



ORGANIZATION OF REFRACTORY MATERIAL MANUFACTURERS.

As was announced in last week's issue, a meeting of those interested in the manufacture of refractory materials was held in the Chemistry Theatre of the University of Manchester, on Wednesday, the 13th inst., and was well attended both by makers and users—practically all the important manufacturing centres being well represented. Mr. Albert Cliff (of Messrs. Williamson Cliff, Limited, of Stamford) occupied the chair, and spoke of the need of some such Association as was proposed. The opinion was, in fact, generally expressed that it was most desirable that a Technical Society of some kind should be formed, and that it should emphasize the manufacturers' side, and develop a close relationship with the users in the various industries, so that all may work together in harmony for the general good.

After some discussion, it was decided, on the proposition of Major Thomas (of Messrs. E. J. & J. Pearson, Limited, of Stourbridge), to form a special Refractory Materials Section of the Ceramic Society, of Stoke-on-Trent. This section is to work independently of the parent Association in arranging its own officers, and in the management of its own meetings, to be held from time to time in the different centres.

During the discussion, Dr. J. W. Mellor said that for two or three years the question of forming a Technical Society for the makers of refractory materials had been pressing itself. Now something had to be done; and, after giving the matter careful consideration, the most advisable thing to do, he felt, was to join up with the Ceramic Society. In the published "Transactions of the Ceramic Society," 80 papers had been given devoted to pottery alone, 78 to pottery and bricks, and 23 were exclusively devoted to refractory materials. Ceramics and refractory materials were inseparable studies; and it would be as reasonable to separate iron from steel, or brass from metal, as to divide them. The Ceramic Society had already a good deal of machinery in operation. Some objection had been taken to the word "Ceramic." His friend Mr. Solon, who, he supposed, knew more about this sort of thing than anyone else, told him that the real meaning of the word was derived from a village near Athens called "Ceramos," where there were clay workers. From that time, it was used for clay working. Then, somehow, it was applied in a more restricted way to pottery alone. The use of the term in America was quite broad, and covered everything connected with clay working.

A Provisional Committee was appointed to meet at Newcastle-on-Tyne last Wednesday, in order to formulate a scheme for the election of officers, to consider what modifications of the rules of the Ceramic Society are necessary to suit the requirements of the Special Refractory Section, and also to appoint a place for the next general meeting of the section.

Coal Supply in Germany.

The issues of the "Journal für Gasbeleuchtung" for November and for the 2nd inst. contain market reports which show that the deliveries of coal are far behind requirements, even for industrial purposes. Gas-works are given a preferential supply after military demands are met; but the scarcity of railway waggons and the general difficulties of transport are responsible for the deliveries being much behindhand. In some coal districts only a third of the requisite number of waggons is available. Prices are rising, notwithstanding regulation by the syndicates under Government control; and for export to Switzerland, for which there is pressing demand, an increase of £8 per waggon of 10 tons of Saar coal was named for November deliveries. Notwithstanding the economy which has been widely practised in lighting, the coal requirements of gas-works have not diminished; but owing to the shortage of waggons, the "Frankfürter Zeitung" states, in regard to the South German coal market, that supplies to gas-works cannot now be on the former scale, notwithstanding the preference accorded to such works. Recently Switzerland has been largely supplied from Belgian pits; but transport difficulties have prevented her demands being fulfilled. Coke is being used to an increasing extent for boiler-firing in Switzerland. The Commercial Association of German Gas-Works, in co-operation with Hugo Stinnes and other German coalowners, and some Dutch firms, has founded a Gas Coke Export Company, with a capital of £50,000, to further business in the export of gas coke. The Company is intended mainly to secure favourable conditions for the export of any surplus coke there may be from German gas-works after the war.

The London and Southern District Junior Gas Association will meet at the Westminster Technical Institute, Vincent Square, S.W., on Friday, Jan. 5. Mr. J. Hewett will read some "Notes on Combustion Methods in the Laboratory;" and this will be followed by questions and discussion by members on subjects of technical interest, during which, if time permits, the President (Mr. S. B. Chandler) will open a discussion on the "Training of the Gas Salesman." Refreshments will be provided by the President. This will be the one meeting of the session.

GAS FOR INDUSTRIAL PURPOSES.

Some Large Installations in the United States.

A NOTABLE feature in the British Isles, in connection with industrial uses of gas, is not only the continually increasing number of purposes to which it is applied, but also the tendency to increase the size, and the consequent consumption, of individual installations, as instanced by the pamphlets issued by the British Commercial Gas Association, under the title of "One Thousand and One Uses for Gas," by the evidence offered in the course of the inquiry relating to the application of the Sheffield Gas Company under the "Calorific Standards Act," and by the reports of those who have given special attention to the development of this important line of business. The increase has been assisted by the introduction of high-pressure distribution, the efficiency of gas as applied to any purpose that calls for accurate regulation of temperature, the numerous improvements continually being introduced by manufacturers of apparatus, and the exorbitant prices obtaining for solid fuels, which in one respect are of advantage in securing a look-in for gas for many purposes; and in respect to many of these, the advantages thus secured will ensure the permanence of the installation.

Judging by the report of the Industrial Fuel Committee of the American Commercial Gas Association, presented at the annual meeting held last month, a similar experience prevails in the United States, where the gas industry has not been hampered for more than two years with onerous war difficulties; and the present year has seen gas adopted for industrial uses to an extent never previously equalled.

The Franklin Automobile Company, of Syracuse, have installed indirect heated japanning ovens that will consume approximately 800,000 cubic feet of gas per month, with such satisfactory results that the outfit is now being duplicated. The output per cubic foot of floor space has been substantially increased, and the finish of the goods improved. The Seng Company, of Chicago, have put down a similar oven, 50 feet in length, consuming about 750,000 cubic fect of gas per month; and many of 500 cubic feet heating space and over have been brought into use throughout the country.

The Eddystone Munition Corporation (Pa.) have probably the largest gas-heated annealing and hardening furnaces in the country, estimated to consume 230,000 cubic feet of gas per diem. [For details of this plant, see "JOURNAL," Vol. CXXXV., p. 603, and *ante*, p. 243.]

At Newark, a hardening and tempering installation, requiring the use of appliances of the retort type, will account for 350,000 cubic feet of gas per month, and at the same works it is proposed to put down furnaces for rolling hot steel that, on an average, will use 250,000 cubic feet per month. Oil and coal have been used for these purposes for 25 years; and the business was secured with gas at 75 c. per 1000 cubic feet, as against oil at 5¼d. per gallon, and coal at $6·75 per gross ton. The introduction of gas was figured-out on the basis of total costs, as the more efficient heat application; and reduction of labour thus rendered possible meant a net saving of $3 per ton of material handled.

At Brooklyn, one of the largest dry-dock companies have adopted a high-pressure gas system in conjunction with oxygen for cutting steel, that would operate up to 100 torches at any one time, with provision for duplication when required. Blau gas was previously used. Each torch required 50 cubic feet of gas per hour; and an annual consumption of about 2½ million cubic feet was anticipated. This order was secured after exhaustive experiments with other gases, and had proved the means of introducing gas for other purposes, such as brazing, pipe bending, and rivet heating.

A recently fitted complete kitchen equipment for the Waldorf-Astoria Hotel in New York was supposed to be the largest of the kind in the country. Gas had been largely adopted in connection with the dye industry. Many operations connected with it required accurate control and the possibility of instantaneously extinguishing the heating medium, and no other fuel was so readily adapted to these purposes as gas. Nearly all gas undertakings had experienced a remarkable sale of gas-fired steam-boilers up to 15 or even 20 H.P.; and the average horse power sold by the larger companies would be more than double as compared with any previous year. Simplicity in control, and in automatic proportioning of air and gas, had long been desired, and to-day, both air-blast and high-pressure appliances were being placed on the market which secured control of both air and gas supply by the operating of a single tap. Large numbers of thermostats, [illegible]ted for all degrees of temperature, had been sold during the year, and were so effective that they entirely eliminated spoiling of material by over-heating, saved labour, and economized fuel. Many new ideas and new applications for gas had been proposed, and particular attention was being given to the conversion of convected to radiant heat, and the direct application of it to the work in hand. As a result, it was possible to develop higher degrees of temperature than heretofore, to reduce flue losses, and thus increase thermal efficiencies.

Among the arrangements announced by the Royal Institution for their Friday evening discourses for the before Easter session is for Mr. Charles Carpenter, D.Sc., M.Inst.C.E., on Feb. 2, to deal with "The Supply of Gaseous Energy (experimental)."

HYDROCARBONS CONTAINED IN COAL.

In a paper read before the French Academy of Sciences by MM. Aimé Pictet, L. Ramseyer, and O. Kaiser, the authors record the results of examining the extract obtained from coal by the use on a large scale of boiling benzol as the solvent. The following is a translation of their communication.

As recorded in two previous papers of 1913 and 1915 respectively, the authors had found that in the distillation of coal under reduced pressure, a tar [exhaust tar] is formed, which contains chiefly hydrocarbons of the hydro-aromatic series. Further experiments were, therefore, made with the object of discovering whether these bodies exist as such in the coal or are products of decomposition or depolymerization by heat. Recourse was thus had to the treatment of the coal with neutral solvents, on the lines of the experiments made since those of Commines and Marcilly in 1862, and by investigators such as Vignon, Wahl, F. Fischer, and Glund. In these, however, the object has been chiefly to ascertain the relative extractive powers of different solvents. The method hitherto has not led to the isolation of a definite body of known constitution or even composition. Experiments on these lines were, therefore, undertaken on a soft Sarre coal (of Maybach) using boiling benzol as the solvent. By the courtesy of the Basle firm of F. Hoffmann, La Roche, and Co. it was possible to operate on a fairly large scale—5½ tons of coal being treated in the technical laboratory of the firm in an extractor of the Soxhlet type.

The coal, previously broken to fragments the size of a pea, was extracted for four days. The solution was then distilled down to a bulk of 20 litres, and addition made of 100 litres of petroleum ether boiling at from 35° to 90° C. By this addition, 2·7 kilogrammes of an amorphous light brown powder was precipitated, and has been set aside for investigation. The fluid part of the mixture, on evaporation on a water-bath, yielded a thick brownish liquid weighing 10·6 kilogrammes. The total extract thus amounts to only 0·25 per cent. It can be increased by reducing the coal to a finer state of division; but the extraction then presents practical difficulties.

The liquid extract is closely allied to the tar obtained by distillation under reduced pressure. It possesses the same odour and density; and the chemical composition is very similar. It contains, as does the tar, about 0·5 per cent. of basic substances, and 2 per cent. of oxygenated bodies of alcoholic type. The remainder consists of hydrocarbons, of which about 25 per cent. are saturated; the remaining 75 per cent. unsaturated.

In order to separate these compounds, the same procedure as that adopted for tar from exhausted retorts was followed—*i.e.*, successive treatments with hydrochloric acid, sodium, and anhydrous liquid sulphur dioxide. The hydrocarbons were then afterwards subjected to fractional distillation over temperature ranges covering each 2° C. The chief fractions were analyzed, and determinations were made of their molecular weight, density, and index of refraction. It was thus possible to fix the constitution of some of the hydrocarbons by converting them into known bromo or nitro derivatives in the aromatic series.

The following compounds have thus been isolated and their characteristics determined:

Non-Saturated Hydrocarbons.

Formula.	Boiling Point.	Density at 20° C.	Index of Refraction at 20° C.	Constitution.
	Degrees C.			
C_7H_{10} . .	108—110	0·7970	1·4444	Dihydro-toluene
C_8H_{12} . .	135—137	0·8324	1·4697	Dihydro-meta-xylene
C_9H_{14} . .	166—168	0·8454	1·4773	Dihydro-mesitylene
$C_{10}H_{16}$ . .	180—182	0·8482	1·4850	Dihydro-prehnetol (?)
$C_{11}H_{16}$ . .	200—202	0·8745	1·4948	,, ,,
$C_{11}H_{16}$ . .	236—238	0·9593	1·5523	,, ,,
$C_{13}H_{12}$ . .	251—254	solid: melts at 109°.	—	Dihydro-fluorene (?)

Saturated Hydrocarbons.

C_8H_{16} (?) .	118—122	0·7492	1·4076	Dihydro-fluorene (?)
C_9H_{18} (?) .	135—138	0·7551	1·4106	,, ,,
$C_{10}H_{20}$ (?) .	172—174	0·7759	1·4205	,, ,,
$C_{11}H_{22}$ . .	190—192	0·7827	1·4250	,, ,,
$C_{12}H_{24}$ . .	215—216	0·7887	1·4319	,, ,,
$C_{13}H_{26}$ . .	227—229	0·7952	1·4370	,, ,,
$C_{30}H_{60}$ . .	below 300	solid: melts at 62—63	—	Melene

The question now arises as to whether these hydrocarbons, extracted from coal at a temperature of 80° C., are the same as those obtained by distillation at 450° C. under reduced pressure. In regard to this it is not yet possible for the authors to say that the non-saturated hydrocarbons are the same; the investigation of the bodies in the tar being not yet complete. But it is clear that certain of the saturated hydrocarbons are the same. Ultimate analysis of the first three fractions has given figures which are a little too high in hydrogen, which indicates that the hydrocarbons of the C_nH_{2n} series contain a small proportion of the C_nH_{2n+2} series. Leaving these out of consideration for the time being, it can be stated in respect to the three hydrocarbons, the analysis and cryoscopic measurement of which afford the formulæ $C_{11}H_{22}$, $C_{12}H_{24}$, and $C_{13}H_{26}$, that their properties correspond absolutely with those of the compounds of identical composition extracted from the tar obtained by reduced-pressure distillation. They are, in turn, identical with the naphthenes found by M. Mabery in Canadian petroleum. It can thus be affirmed that the solid hydrocarbon $C_{30}H_{60}$ found by the authors is identical in all respects with the melene either from exhaust tar or from Galician petroleum.

Part at least of the hydrocarbons in exhaust tar exist as they do in the coal. Distillation under reduced pressure separates them only by simple volatilization, unaccompanied by decomposition changes. According to this view, coal appears to be a solid hydrocarbon material impregnated with a liquid chemically analogous to petroleum.

This last analogy is rendered still more striking by the fact that this liquid portion of the coal exhibits (as do most petroleums) characteristic optical rotatory power. In its entirety, the coal extract is very feebly laevo-rotatory (− 0·08°). After removal of the alcohols with sodium, it becomes dextro-rotatory (+0·27°). On separation of the hydrocarbons from each other with liquid sulphur dioxide and fractional distillation, it is noticed that none of the fractions have any effect—either dextro or laevo—on polarized light. The same thing is observed in the case of low fractions of saturated hydrocarbons up to about 180° C. The rotatory power reappears in the upper fractions, but then changes its sign from one to another. Thus the fraction 215° to 216° C. ($C_{12}H_{24}$) gives a deviation of − 0·53; that of 227° to 229° C. ($C_{13}H_{26}$), one of + 1·56. As is well known from the work of Engler and Steinkopf, the petroleums do exactly the same.

No optical activity has been found by the authors in any fraction of the exhaust tar, whence it may be concluded that the temperature of 450° C. suffices to nullify the optical activity of the active volatile substances in the coal, or rather to produce opposite and equally balanced rotatory properties. The phenomenon likewise supplies proof that the materials which have formed have never been brought to this temperature.

ESTIMATION OF SULPHUR IN COAL OR COKE.

A Simple Method.

A process recommended by "Gas Record" comprises combustion of the sample with an excess of sodium peroxide, solution of the residue in water, acidifying with hydrochloric acid, boiling, and precipitation of the sulphur as barium sulphate, with the usual precautions. The weight of precipitate obtained, multiplied by 0·13732, gives the weight of sulphur in the sample, which can be calculated out as a percentage.

A fair average sample of the fuel to be tested is powdered as finely as possible, and ½ gramme to 1 gramme, according to the quantity of sulphur expected to be present, is intimately mixed with 15 to 20 grammes of finely-powdered sodium peroxide, which must be pure and free from sulphur. A very-finely divided condition of both ingredients is essential. The mixture is transferred to a perfectly clean nickel crucible, and a thin layer of sodium peroxide sprinkled over the surface, taking care that it is completely covered. The lid, which must have a small hole in the centre, is then placed in position, and the crucible immersed in distilled water up to the level of the contents, contained in a porcelain evaporating basin about 7 inches in diameter. A thin iron nail is heated in the bunsen flame, and when red hot is inserted into the crucible through the hole in the lid. This starts a violent reaction and heating; the coal being rapidly burnt-up and oxidized by oxygen supplied by the sodium peroxide, and the sulphur retained as sodium sulphate. There should be no smoke. If any is produced, imperfect mixing or preparation is indicated, and the result will not be reliable.

When the action has ceased and the vessel fairly cooled, it is tilted to one side, so as to allow the contents to be immersed in the water, and the basin covered with a clock glass, to avoid loss. When the soluble ingredients are entirely dissolved, and the action due to the decomposition of the excess of the oxidizing agent has ceased, the crucible and its cover are separately removed with tongs, thoroughly washed with distilled water, allowing the washings to fall into, and mix with, the solution in the basin, which is then acidified, insoluble matters removed by filtration, the residue well washed, and the sulphur precipitated as above mentioned.

Next American Gas Institute Meeting.—Absence of sufficient notice will not be the reason for non-attendance of any member at the twelfth annual meeting of the American Gas Institute. It is officially announced that the Committee appointed to select the place of the 1917 meeting have decided upon the City of Washington (D.C.); the date to be from Oct. 16 to 19.

Vitrified Pipes for Steel Purifier Outlets.—A "wrinkle" contributed by Mr. G. T. Creighton at the annual meeting of the Pacific Coast Gas Association was to the effect that, on account of the excessive rusting of the steel outlet-pipes of steel purifiers, the Los Angeles Gas and Electric Corporation substituted ordinary vitrified sewer pipe, with gratifying results, packing the joints with oakum and red lead. Sewer pipe is immune to the chemical action, and, further, is considerably cheaper.

LOCAL GOVERNMENT FINANCE.

Summary of the Local Taxation Returns.

One of the Blue-Books which appears once more in its former size, in spite of all difficulties—and, incidentally, is issued just as long as has hitherto been the case after the passing of the events to which it refers—is the Summary of the Annual Local Taxation Returns. This is Part VII. of the series; and the volume for the year ended March, 1914, was issued a few days ago. In many important respects, local government affairs have altered in the interval which has since elapsed; but the statistics contained in this particular Blue-Book will be in request for future reference, relating as they do to the latest financial year under peace conditions. It should be pointed out that no corresponding volume was published for the year 1912-13; but the principal totals for that year are set out in the present report.

The report shows that 25,604 separate authorities embraced by the definition fixed for the purpose in the Local Taxation Returns Acts had financial transactions during the year 1913-14. The receipts quoted include the sums received by local authorities from Exchequer grants towards expenses incurred in regard to elementary education, as well as the gross receipts from water, gas, electric lighting, tramways, and other undertakings carried on by them, and miscellaneous receipts from rents, &c. Money borrowed to meet capital expenditure is distinguished from other sums. The expenditure included is that defrayed out of the receipts indicated. The number of local authorities who had expenditure, other than that defrayed out of loans, during the year in respect of water supply was 1206, of gas supply 245, of electric light supply 254.

The total amount of public rates received in the twelve months ended March, 1914, was £71,276,158, of which 23 per cent. was collected in areas in the Administrative County of London. The receipts also included £22,617,246 from Exchequer grants, and the following (among other) sums transferred in aid of public rates: £592,015 from gas undertakings, £219,187 from water supply, and £218,493 from electricity. The total receipts of the local authorities from sources other than loans amounted to £149,347,999. At the commencement of the year 1913-14, the total of the gross value or gross estimated rental of the rateable hereditaments in England and Wales was £279,337,914; the total rateable value was £223,559,349; and the total assessable value for purposes of the Agricultural Rates Act was £211,563,049. Taking England and Wales as a whole, gross value or gross estimated rental increased between the commencement of the year 1912-13 and 1913-14 by £3,841,961, or 1·4 per cent.; and the rateable value by £2,547,517, or 1·2 per cent. The average amount of public rates per pound of assessable value for the year 1913-14 was 6s. 8·9d., as against 6s. 6·3d. the previous year, or an increase of 2·6d. When calculated on the estimated population, the amount per head was £1 19s. 0·6d., compared with £1 17s. 7·2d., or an increase of 1s. 5·4d.

In the year dealt with by the present return, the loans raised by local authorities amounted to £19,977,119, which was £2,464,196 more than the exceptionally small total raised by them in 1912-13. The amount received from loans during the year for gas-works was £746,563, as compared with £482,824 the preceding year; for water-works, £1,662,513, against £1,767,495; and for electric lighting, £2,030,086, against £1,629,801. The total amount of loans outstanding at March 31,. 1914 (including £49,721,498 for the Metropolitan Water Board), was £562,630,045, compared with £557,321,337; and the amount standing to the credit of sinking funds and other similar funds applicable towards the repayment of such part of the loans as was repayable out of these funds was £35,701,828, against £34,697,358. If the amount standing to the credit of sinking funds towards the future repayment of outstanding loans be deducted from the total amount of loans outstanding, an amount is obtained which may be called the net outstanding loan debt. This at the end of the year 1912-13 amounted to £522,623,979, and at the end of 1913-14 £526,928,217, an increase during the year of £4,304,238, or 0·8 per cent.

With regard to the outstanding loan account of £562,630,045 at March 31, 1914, it is seen that the relative proportions in which the amount was distributed over the various purposes for which it had been borrowed were: Gas-works, electric lighting, water-works, and other reproductive undertakings, £310,156,466, or 55·1 per cent. Education accounted for 9·3 per cent.; highways, bridges, sewerage, &c., 19·3 per cent.; and other purposes, 16·3 per cent. Of the first item, £22,537,201 related to gas-works, £30,790,851 to electric lighting plant, and £131,095,217 to water supply. The average amount per pound of rateable value, over England and Wales, of the total loans outstanding at March, 1914, was £1 6s. 6d. for revenue-bearing undertakings, and £1 3s. 10d. for all other purposes. The average amounts per head of the estimated population were respectively £8 2s. 8d. and £7 5s. 7d.

The following are among the items which went to make up the total receipts of the local authorities of £149,347,999 for 1913-14: Gas undertakings, £8,716,230; electric lighting, £5,369,470; water supply, £8,661,319. The gross revenue of the gas undertakings carried on by the authorities rose from £8,643,351 in 1912-13 to £8,773,393 in 1913-14. With electric lighting undertakings (excluding sums received for power supplied to the authorities' own tramway undertakings), the increase was from £4,870,580 to £5,422,942; and for water supply, from £8,500,601 to £8,758,285. The expenditure, excluding loans, was £148,259,788 for 1913-14. The expenditure in respect of gas supply undertakings increased from £7,790,009 in 1912-13 to £8,517,330 in 1913-14; that of electric lighting, from £4,742,121 to £5,194,720; and of water-works, from £8,921,154 to £9,135,371. The amount of profits, or surplus revenue transferred in aid of the rates from trading undertakings has already been stated; the totals of the amounts which had to be transferred to meet deficiencies in the accounts of other undertakings of similar character were: Gas-works, £58,202; water supply, £721,260; electric lighting, £63,453.

RECENT RESEARCHES ON THE CONSTITUTION OF COAL.

The constitution of coal has been the subject of many investigations in recent years, notably by Mr. R. V. Wheeler and various collaborators in this country, by M. Aimé Pictet and colleagues in France, and by Herr F. Bergius in Hanover. The starting point of many of these investigations has been extraction of the coal by certain solvents, especially pyridine; and work in this direction has been carried farthest by Mr. R. V. Wheeler, who in collaboration with Mr. D. T. Jones, recently presented a further communication to the Chemical Society on "The Constitution of Coal." The work recorded in this paper was carried out in the laboratories of the Home Office Experimental Station at Eskmeals, Cumberland. In the "Journal für Gasbeleuchtung" of Oct. 7 last, there is a paper by Dr. E. Terres, on "The Combination of Nitrogen in Coal and Coke," which is a communication, from the Chemical Technical Institute of the Technical College at Carlsruhe, in which some of the more recent German work on the constitution of coal is reported and discussed. It will be useful to give summaries of Dr. Terres' paper, as well as that of Messrs. Jones and Wheeler.

Dr. Terres states that the nearly complete insolubility of coal in all solvents except strongly oxidizing acids has made this method of investigation, which with other materials has proved so successful, of very little service. The less reliable method of study by analogy has therefore been followed by many, and has yielded some useful conclusions. Gumbel's investigations of the cell structure of coal, made with the aid of the microscope in 1883, definitely traced the origin of coal to the conversion of the substance of plants, chiefly cellulose, into coal substance. This has been effected principally by formation of carbonic acid and water from the oxygen of the cellulose or plant substance, which accounts for the relatively small proportion of oxygen left in coal. When the oxygen has fallen to a very small proportion, as in anthracitic coals, the hydrogen becomes reduced by the splitting-off of methane and hydrogen, and true anthracite results.

Source of the Nitrogen in Coal.

There is another constituent of coal—viz., nitrogen—which, though present in relatively small amount, is never entirely absent. Peat generally contains 0·9 to 2 per cent. of nitrogen, but in rare instances as much as 4 to 6 per cent.; while in coal proper the nitrogen very rarely exceeds 1·75 to 2 per cent., and in anthracites it generally amounts to 1 per cent., though not infrequently it falls to one or two tenths of one per cent. It is noteworthy that in one and the same seam of coal, the nitrogen fluctuates much more than the other constituents—viz., by as much as 20 to 25 per cent. of its amount. What is the source of the nitrogen in coal? Wood never contains more than 0·1 per cent., which is also the proportion in bog vegetation. Yet even the youngest conversion product—viz., peat—contains ten to twenty times this proportion; so that clearly the nitrogen in wood and plants is not sufficient to furnish the higher proportion found in peat and coal. It must be assumed that the greater part of the nitrogen in coal is ultimately derived from the atmosphere, through animal remains mixed with the vegetable matter. Thus the nitrogen would come chiefly from albuminoid organic substances, and would be present in coal in the form of complex organic compounds. This theory would be strongly supported if albumin, or the amido groupings which result from its decomposition, were discovered in coal. Actually, Rau and Christie in 1908 detected the presence of amido groupings in peat and prepared humic acid, by means of the distinct smell of isonitril which was produced on treatment with potassium ethylate and chloroform. But they could not detect albumin itself in peat, nor amido groupings in other types of fuel.

Distribution of Nitrogen in Carbonization.

In the carbonization of coal, the nitrogen appears as free nitrogen, ammonia, and cyanogen, and in some form in which it is unaffected by high temperature in the coke. Cyanogen probably results from certain secondary reactions. Drs. H. & K. Bunte have studied the distribution of the nitrogen in the carbonization of many coals; and while it is affected by the heat and duration of carbonization, it may be said that, generally speaking, 40 to 65 per cent. of the nitrogen is found in the coke, 10 to 14 per cent. is recovered as ammonia, and the remainder is found as elementary nitrogen, as cyanogen, or in the tar. It seems probable that the

whole of the nitrogen split-off is initially in the form of ammonia; and analyses of samples of the gas liberated at different stages of carbonization show that the ratios of ammonia, nitrogen, and hydrogen are in fair agreement with the equilibrium constants for the prevailing temperature. Very slow distillation of coal, which allows of complete exhaustion of the gas at each stage with a gradually increasing temperature of distillation, has been found by Rau and Christie to give as much as 35 per cent. of the nitrogen in the form of ammonia.

Carbonization of Nitrogen Compounds.

Dr. Terres carbonized a number of pure nitrogen compounds in a porcelain tube heated electrically to 700° to 900° C. with a view to ascertaining which nitrogen groupings yielded ammonia. The compounds taken were: Glycocol, asparagin, albumin, pyridine, azobenzene, hydrazobenzene, acetonitril, phenylisocyanate, and nitrobenzene. They represented the amido and substituted amido groupings, and the azo, hydrazo, nitril, isonitril, and nitro groups. The ammonia and free nitrogen produced were determined, as was also the nitrogen in the residual coke. It was found that only the amido and substituted amido groupings were capable of splitting off ammonia; and it may therefore be concluded that the nitrogen of coal is thus combined, and that it must originally have been of an albuminoid character. It appeared probable that if the nitrogen were in some simple combination, extraction of coal would give an extract containing a higher proportion of nitrogen than the residue. A finely powdered Saar coal (Heinitz), containing 1·15 per cent. of nitrogen, was extracted with benzene, chloroform, paraxylene, and pyridine; and the nitrogen in the residues and (except in the case of pyridine) in the extracts was determined. The results proved that the nitrogen of the coal showed a preference for extraction. Further larger scale investigations, including extraction under pressure, have been interrupted by the war. So far amido groupings have not been detected in the extracts.

The Nitrogen in Coke.

The greater part of the nitrogen of coal is found, on carbonization, in the coke, in which it is contained in a form in which it resists expulsion at a temperature of 850° C., and the investigation of which is a very difficult problem. Above 850° C., the nitrogen is slowly split off from coke, and to an increasing extent as the temperature is raised, until, at 1400° to 1500° C., the greater part of the nitrogen has been expelled. At 1800° C., Rau and Christie obtained a coke free from nitrogen. The nitrogen can only be in combination with carbon—probably as a nitride of carbon; and these investigators, after many efforts, produced an artificial coke, by the decomposition of gaseous cyanogen by heat, in which there were 11·6 parts of carbon to one part of nitrogen. This product withstood a high temperature, though at temperatures from 960° to 1350° C., it was decomposed into its elements rather more quickly than the coke compound of nitrogen. The nitrogen was given off in the free state.

Dr. Terres investigated the matter by observing the behaviour of the nitrogen of coke under the action of steam at high temperatures, because a nitride, if present, would in these conditions generally yield ammonia. A well carbonized coke, of exactly determined composition, was gasified at different temperatures in air to which precisely ascertained quantities of steam were added. It was found that the yield of ammonia increased as the quantity of steam was increased; the best temperature being 800° C. Sachs succeeded, by drawing off the gases before decomposition of the produced ammonia took place, in recovering over 89 per cent. of the nitrogen of the coke in the form of ammonia. This result strongly supports the view of Rau and Christie that the nitrogen exists in coke as a nitride of carbon.

Action of Solvents on Coal.

While the Carlsruhe chemists think that the study of coal by means of the action of solvents on it has proved comparatively fruitless, it is evident from the results of the work of Dr. R. W. Wheeler and his colleagues that this is not the case. Messrs. Jones and Wheeler point out that extraction of the dried coal with pure dry pyridine leaves an insoluble residue consisting mainly of cellulosic constituents. If the pyridine extract, after removal of the pyridine, is extracted with chloroform or benzene, a further residue of cellulosic compounds is obtained, while the extract consists of resinous compounds. This extract differs from both the cellulosic residues, in that: (1) It softens at 100° C., whereas they are infusible; (2) it undergoes oxidation on exposure to air, exerting photochemical action on a sensitized plate, as resins do, whereas they do not; (3) it yields on distillation in a vacuum gas differing markedly in quantity and composition from the gas produced from them in the same conditions, and (4) it yields a large quantity of liquid distillate or tar, which is free from phenols, whereas they yield small quantities consisting almost entirely of phenols. The residues from the pyridine extraction and from the chloroform extraction of the pyridine extract behave similarly in all these respects, and both consist clearly of cellulosic compounds.

Nature of the Cellulosic Constituents.

Boudouard, in 1909, showed that unchanged celluloses were practically absent from bituminous coal; the cellulosic compounds present being degradation products of the original plant celluloses, and resembling cellulose in yielding phenols on destructive distillation. The production of phenols is due to the presence of the furan grouping, which is more stable than the cellulose molecule and would remain unchanged when the latter underwent degradation changes. Probably the cellulosic constituents of coal do not comprise many types of compounds. It is possible that in some of the cellulosic derivatives molecules approximating in structure to the carbon molecule may have resulted from the cellulose grouping.

Absence of Free Carbon in Coal.

The agencies which have produced coal are bacterial decay, heat, and pressure. It is highly improbable that micro-organisms can have effected a segregation of free carbon; while it is equally improbable that coals in general can ever have approached during their formation a temperature as high as 300° C., which is too low to effect complete carbonization. Pressure is adverse to molecular disintegration; so that it is unlikely that these factors, singly or together, can have brought about the complete carbonization of any portion of the mother substance of coal. But there are similarities of behaviour between carbon and coal, which indicate that the latter contains molecules similar in type to the carbon molecule—*i.e.*, a structure involving a six-carbon ring, and containing the fluorene grouping.

The Resinous Compounds in Coal.

The resinous or resinic compounds comprised in the chloroform extract of the pyridine extract of bituminous coal have presumably been derived from the gums, resins, starches, sugars, &c., in the original plants. They comprise compounds containing residual alkyl, naphthene, and unsaturated hydro-aromatic radicles attached to larger and more complex groupings. The compounds obtained as low temperature distillates of coal are for the most part decomposition products not present in a free state in coal, and, according to the authors' hypothesis, resulting from "bound" molecules. This hypothesis, however, would not account for aromatic compounds, corresponding by analysis with dimethylnaphthalene, distilling from coal at a temperature of 300° to 350° C. Their formation by elimination of hydrogen from hydroaromatic compounds is unlikely, but may be due to the splitting-off of a radicle with hydrogen from hydrogenated nuclei. As regards the oxygenated compounds in the resinous constituents of coal, the indifference of coal to saponifying and hydrolysing reagents makes it improbable that much of the oxygen is in the hydroxylic or carboxylic grouping.

The Hydrocarbons in Coal.

The presence of traces of free hydrocarbons in coal has been proved by the extraction of hexahydrofluorene, melene (a solid naphthene, $C_{30}H_{60}$), and heptacosane (a solid paraffin, $C_{27}H_{56}$). Further, coal must contain hydrocarbons in a bound state, from which they are liberated on distillation. Similarities in naphthenes derived from coal and certain petroleums point to the presence in the parent substances of both coal and petroleum of compounds, such as aliphatic esters, which are common to both vegetable and animal remains. Phenols, derived from the cellulosic constituents of coal, are always present in the distillates from coal, but not in petroleum and its distillates. This points to the parent substance of petroleum having been free from material of cellulosic structure, and is evidence in favour of the non-vegetable origin of petroleum.

Extraction of Coal under High Pressure.

The investigation of the extraction of coal under high pressure, which Dr. Terres stated had been interrupted by the war so far as the Carlsruhe laboratory was concerned, has been pursued by other German chemists—viz., F. Fischer and W. Glund—who have reported their results in a recent number of the "Berichte" of the German Chemical Society. They used a special autoclave, and in most cases benzene as the solvent, working at a maximum temperature of about 275° C., which, with benzene, corresponds with a pressure of about 55 atmospheres. In these conditions, as much as 6·6 per cent. of ordinary bituminous coal was extracted in five successive extractions, though the residue did not differ greatly in appearance from the original coal. Half of the extracted substance went solid at ordinary temperatures. Lignite in the same conditions gave up to the solvent 25 per cent. of its weight in three successive extractions; but there was considerable decomposition of the lignite, with evolution of sulphur compounds. Cannel yielded only about 4 per cent. of extractable substance.

The same chemists have made some extractions of coal with naphthalene at 350°, at which temperature there is considerable decomposition of the coal and an extraction of 25 to 30 per cent. of its weight. They also attempted extractions with liquefied sulphur dioxide at low temperatures, which broke up bituminous coal to a powder and gave an extract nearly free from solid matter, while scarcely attacking anthracite and cannel. The extract from lignite with benzene at 275° C. is a mixture of a resin with a wax; but the sulphur dioxide extract is resinoid only.

Herr Franz Fischer has also studied the effect of submitting coal suspended in water to a stream of ozone, and has found that the coal is gradually almost completely dissolved. The resultant dark-coloured solution is strongly acid, which is probably due to a secondary reaction between the water and the ozonides of the coal substance.

MEADOW LANE GAS-WORKS, LEEDS.

A visit was paid last Saturday week, by the Yorkshire Association of Students of the Institution of Civil Engineers, by permission of the Engineer and General Manager (Mr. W. B. Leech), to the Meadow Lane Gas-Works of the Leeds Corporation. In anticipation of the inspection, the following description of the plant installed was circulated among the members by the Hon. Secretary (Mr. Stanley G. Hay).

Coke-Oven Gas-Meter.—Capacity, 75,000 cubic feet per hour.

Purifiers.—Three boxes 42 feet square by 6 feet deep, 24-inch connections. Now used for lime. To be fitted with Pickering's connectionless valve and used for oxide.

Calorimeter Room.—Two Beasley recording calorimeters—one working on coke-oven gas and one on mixed coke-oven and carburetted water gas. Edwards sulphuretted hydrogen recorder.

Engine Room.—Two exhausters, capacity 80,000 cubic feet per hour each. One twin exhausting set removed from coal-gas plant, 200,000 cubic feet per hour. Two high-speed steam-engines and blast fans. One Crossley tar-extractor driven by 20 B.H.P. motor. Circulating water and oil pumps.

Carburetted Water-Gas Plant.—Three units each of 900,000 cubic feet per 24 hours. To be remodelled to increase capacity from 2,700,000 to 4,500,000 cubic feet per 24 hours.

Boiler-House.—Two Lancashire boilers fitted with Meldrum's breeze furnaces. Steam pressure, 125 lbs. per square inch.

Relief Holder.—Three lifts, 57 feet diameter by 20 feet deep.

Oil-Tanks.—35 feet diameter by 30 feet deep. Capacity, 180,000 gallons of oil.

Condensers and Scrubbers.—Two Clapham's water-cooled condensers. Four scrubbers, 5 ft. 6 in. diameter by 30 feet high.

Purifiers (Catch Boxes).—Two oxide boxes, 35 feet by 30 feet by 6 feet deep, with 24-inch connections and Pickering's connectionless valve.

Carburetted Water-Gas Meter.—Capacity 85,000 cubic feet per hour.

Gasholders.—No. 1, three lifts 106 feet diameter by 22 feet deep. Capacity 529,000 cubic feet, cast-iron tank. No. 2, three lifts 250 feet diameter by 30 feet deep. Capacity 5,163,000 cubic feet. Steel tank.

Calorimeter House.—Beasley recording calorimeter for coal gas, also sulphur test, &c.

Governor and Compressor House.—Three station governors—two 36 inches diameter and one 24 inches. Two compressing sets direct driven by gas-engines, 4000 cubic feet per hour each. Two compressing sets direct driven by gas-engines, 20,000 cubic feet per hour each. One pressure-raising fan direct driven by 4 B.H.P. motor capable of passing 150,000 cubic feet per hour against 3-inch pressure difference.

Purifiers.—Two sets each of four oxide boxes, 30 feet by 20 feet by 6 feet deep, with Weck valves.

Condensers.—Six sets of air-cooled condensers. One set now used to cool tar for "C" process.

Tar-Extractors.—Two Pelouze and Audouin tar-extractors. Capacity 4 million cubic feet per 24 hours each.

Washers.—Four sets of Walker's purifying machines. Capacity 2 million cubic feet per 24 hours each.

Purifiers.—Two sets of four oxide boxes and two catch boxes, all 30 feet by 20 feet by 6 feet deep, with centre valves.

Yard Railways.—All coal, coke, lime trucks, oil-tanks, &c., handled by works' locomotives, which operate between Midland goods yard and works' sidings.

Exhauster House.—Two twin exhausting sets. Capacity 200,000 cubic feet per hour each. One Bryan-Donkin turbo-exhauster about to be erected, capacity 200,000 cubic feet per hour, with Terry steam-turbine, direct coupled.

Boiler-House.—Three Lancashire boilers fitted with Goodrich and Hamlyn's noiseless breeze furnaces. Steam pressure 65 lbs. per square inch.

Meter House.—Two station meters. Capacity 110,000 and 70,000 cubic feet per hour, respectively.

Inclines Coal Plant.—Hydraulic capstan and waggon tippers. Coal receiving hopper. Two steel tray conveyors, capacity 45 tons per hour each, driven by 20 B.H.P. motor. Duplicate breakers, elevators, and conveyors driven by steam-engines.

Inclined-Retort House.—Four benches, each containing seven beds of seven inclined retorts. Total capacity 2,750,000 cubic feet per day. Retorts 20 feet long, 20 in. by 15 in. at top and 24 in. by 15 in. at botiom, ⏢ section.

Telpher Plant.—Strachan and Henshaw's monorail type, handles coke from both inclined and vertical retorts. Two-phase alternating current.

Coke Screening and Grading Plant.—Coke fed into 100-ton storage bunkers by telphers and screened by Zimmer jigging screens into carts. Breeze separated out is deposited by rubber belt conveyor into elevator, which feeds it into an Allison grader (capacity 10 tons per hour), which grades the breeze into three sizes—dust, smithy breeze, and walnut coke. The coke screens and grader are driven by 12 B.H.P. and 8 B.H.P. motors respectively.

Horizontal Retorts.—Four benches of retorts. Total capacity 2,000,000 cubic feet per day.

Vertical Retorts.—Two benches of intermittent vertical retorts, each containing five beds of eighteen retorts, 13 ft. 1½ in. long. Total capacity 2,300,000 cubic feet per day. Retorts 9 in. by 22⅓ in. at top and 14½ in. by 27½ in. at bottom. Twelve-hour charges of 9 cwt. each, steamed for last two hours. Step-grate furnaces. Hydraulic capstan and waggon tipper, coal receiving bunker, elevator and conveyor driven by two 12 B.H.P. and one 8 B.H.P. motors. Hydraulic coke hoist. Hot coke conveyor, De Brouwer type, driven by a 12 B.H.P. motor. Underground filtration tank for saving and re-using quenching water, now being built. Filtered water will be raised to overhead supply tank by Rees roturbo centrifugal pump direct driven by 5 B.H.P. motor.

Pump House and Workshops.—Containing new set of 7000 gallons per hour hydraulic pumps, four new tar and liquor pumps, and existing hydraulic pump. Two hydraulic accumulators are outside this house.

The visit was well timed, as it followed three days after the reading of a paper to the members by Mr. Frank H. Robinson, the Engineer to the Harrogate Gas Company, on the "Carbonization of Coal," which was illustrated by lantern slides. The different methods were dealt with, as well as the chemical and physical changes occurring during carbonization, and the temperatures worked in coke-oven installations and gas-works and their effects on the products.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Ammonia, Sulphuretted Hydrogen, and Steel Tubes.

SIR,—I should like to thank both Mr. Parrish and Mr. Harman for their communications respecting my letter, published in the "JOURNAL" for the 12th inst., with reference to the suggested action of ammonia on steel tubes.

Mr. Parrish is undoubtedly correct in stating that it is the action of sulphuretted hydrogen and the sulphur compounds, and not the ammonia, that deteriorates the steel. This confirms some rough laboratory observations made by myself; and it goes to prove that the best position for the oil-washing plant is after the purifiers, where only the sulphur compounds have to be dealt with. This position was advocated in the Presidential Address of Mr. W. Doig Gibb to the Southern District Association of Gas Engineers and Managers, as published in your issue of the 21st ult. (p. 391). But I believe there are several plants (fitted with steel condensing-coils) situated between the ammonia scrubbers and the purifiers that are so far fortunate enough not to have experienced any trouble. Might I suggest that it would be useful to publish a list showing the positions of oil-washing plants in gas-works throughout the country, with notes as to the experience with regard to the deterioration of the condensing-coils.

As Mr. Harman points out, a lot of useful research work could be carried out in connection with benzol-recovery plants by competent investigators. For example, it would be interesting to know to what extent (if any) the wash-oil picked up sulphuretted hydrogen; and if the quantity was sufficient to have any actior on the steel tubes. I quite agree with Mr. Harman that research work in this matter is well worth the attention of the Institution of Gas Engineers.

Dartford, Dec. 20, 1916. BERNARD P. BEZANT.

Alleged Preferential Charges for Electricity at Hackney.

It was intimated in the "JOURNAL" for the 28th ult. [p. 452] that the Electricity Committee of the Hackney Borough Council had caused an appearance to be entered in the action being brought against them by the Gas Light and Coke Company which alleges "preferential treatment" in respect of the charges made for electricity. In view of the importance of the question in dispute, which affects all electricity undertakings, the Borough Council have circularized the local authorities asking for financial assistance in contesting the action. The Electricity Committee of the Newport (Mon.) Corporation recommend the Council to contribute towards the cost, subject to the amount of the contribution being upon the basis of the number of units sold by the contributing authorities, and to there being a general response by other municipalities. The Hornsey Town Council have referred the request to a Committee for consideration.

Wages of Bradford Municipal Workers.—An application for an advance in wages of 10s. per week on pre-war rates, which will affect some thousands of municipal employees, has been presented to various departments of the Bradford Corporation from the National Union of General Workers. Practically every class of worker specified in the application has received advances and bonus since the outbreak of war. The applications will be considered by the various Committees, and their recommendations submitted to the special War Bonus Committee. In presenting the application, it was pointed out that the cost of foodstuffs has increased by about 81 per cent.

Curious Gas Tragedy at Hexham.—After a somewhat remarkable run of domestic gas poisoning fatalities (intentional and otherwise) in Bradford in recent times, it is not a little strange that Bradford should be closely associated with a gas tragedy at Hexham, near Newcastle, where the wife and two little children of the Rev. W. E. Stockley were found dead in the bedroom, and the minister himself in a critical condition. The reverend gentleman was formerly a pastor at a church at Eceleshill, where he was extremely popular; and his deceased wife was an Eccleshill native. In this case, it seems that a gas-stove was found burning in the bedroom; and the chimney was blocked by a jackdaw's nest keeping back the fumes.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Coal Production and Transport.

Mr. MILLAR asked the Under-Secretary of State for the Home Department what further steps have been taken during the past six months to increase the production of coal in the United Kingdom, and to provide railway waggons for the transport of coal from the collieries.

Mr. BRACE: I would refer the hon. member to the detailed information contained in the report which was issued by the Coal Mining Organization Committee in September last. I may add, however, that the arrangements made with the War Office for the release of miners unfit for general service have resulted in the return of over 12,000 men to the mines, and that special measures have been taken to deal with the question of absenteeism. The last part of the question is a matter for the Board of Trade.

Lighting Regulations in the Metropolis.

Captain BARNETT asked whether, in view of the numerous accidents reported in the Metropolitan district during the recent fog, he will in future take steps to secure the temporary suspension of the lighting regulations when fogs occur.

Sir GEORGE CAVE: It is found in practice almost impossible to make arrangements for increasing and again reducing on special occasions the number and brightness of street-lamps. Arrangements have, however, been made to provide emergency lighting in the shape of flares; and these were brought into operation to some extent on the occasion of the last fog.

LEGAL INTELLIGENCE.

"IRONCLAD" GAS-MANTLES.

On Thursday last, the action of *Curtis's and Harvey, Limited v. Bernstein* (otherwise Berney), trading as the East London Mantle Company, again came before Mr. Justice YOUNGER in the Chancery Division of the High Court [*ante* p. 593]. Plaintiffs sought to restrain defendants (father and son) from representing that they were authorized to manufacture for and on behalf of, or as successors of, the plaintiffs, incandescent gas-mantles known as "Ironclad," or from doing anything which should lead to the belief that plaintiffs had ceased to manufacture such mantles.

Mr. CLAUSON, K.C. (for the plaintiffs), said the father appeared to have nothing to do with the son, and said all sorts of things about him. Therefore, he would not ask for any relief against him on the motion. Plaintiffs would investigate the matter; and if they found what he said was accurate, the question could be disposed of afterwards. With regard to the son, he read affidavits made by Mr. Garland, Mr. Metcalf (the Secretary of the plaintiff Company), and Mr. Bambridge, that defendant had offered mantles for sale, stating that they were the manufacture of the East London Company, who made the mantles for plaintiff Company, who had ceased to manufacture.

Defendant (who appeared in person) said what he stated was that the mantles were as good as those of Curtis's and Harvey.

Mr. CLAUSON said his evidence was to the contrary effect. Plaintiffs had not ceased to manufacture mantles; and had no intention of doing so. The mantles sold by the defendant were of a very inferior kind.

Defendant not having put in any evidence,

His LORDSHIP said he should grant an interlocutory injunction until the trial of the action.

Mr. CLAUSON inquired whether defendant was willing to treat the motion as the trial and put an end to the matter.

His LORDSHIP advised defendant to agree to this, pointing out that he could not be allowed to go on repeating the statements which it was said he had made.

Defendant said he was quite content to let the matter end there, and to make a public apology for what he had done. He was very sorry for what he had done and would not do it again.

At the suggestion of his LORDSHIP, plaintiffs agreed not to ask for costs.

A perpetual injunction was granted; his LORDSHIP telling defendant that he thought he had got off very lightly. If defendant again did what was complained of, it would be a serious matter for him.

Irish Water-Rate Litigation.

In the High Court of Ireland, before Lord Chief Justice Cherry and Mr. Justice Madden, application was made for a conditional order of *certiorari* to quash the Howth (co. Dublin) water-rate, which had already been the subject of litigation on a case stated as to whether the rate was bad or not. The object of the application was to enable the case to be taken to the Court of Appeal. Counsel said there was a large sum of money involved; and he moved on the affidavit of Mr. R. Bullick, one of the parties who contested the validity of the rate against the local Council. The Court refused the application, but gave liberty to apply for an absolute order, if the parties were so advised.

Brentford Gas Company's Increased Price.—After the Christmas meter readings have been taken, the Brentford Gas Company will increase the price of gas to 2s. 10d. per 1000 cubic feet—a rise of 4d. The total increase since war started is 6d. per 1000 cubic feet.

MISCELLANEOUS NEWS.

THE NEED FOR CO-OPERATION.

The Christmas Number of the "Co-Partnership Journal" of the South Metropolitan Gas Company contains several features; and altogether the Editor (Mr. Walter T. Layton) is to be congratulated on the production. In addition to the Co-Partnership Almanac, there are an excellent series of photographs of the Company's attractive showrooms at Balham, and the following address by the Chairman—Mr. Charles Carpenter, D.Sc.:

It is far from an easy task to sit down to-day and write a Christmas message; for the peace and goodwill with which we were so long accustomed to associate this period of the year seems farther away from us than ever. Looking back, one cannot but feel how long a time it has taken a large proportion of the Nation to realize that we are at war for our very existence, even if they do so now. In countries near and far our brothers are fighting for us with the one aim and object that the liberty and freedom we have so long enjoyed may be preserved for us. No discomfort we may experience at home can equal the hardships so cheerfully endured by those taking part in the unceasing vigil of the Fleet or the Army. If we needed stimulating in our duty, surely the thought of Belgium's sufferings would provide it. We might indeed go further and ask what stands between ourselves and a similar fate. It seems to me there is but one barrier, and that complete co-operation on the part of the whole Nation, when to every individual thought and action but one consideration can be given—"Will it help to win the war?" I am sure that our co-partners are in the forefront of such. We certainly have never tested their goodwill so greatly. We have had to fill at short notice all sorts of posts with men trained in other ones. We have had to move them from positions where they had for a large part of a lifetime been conveniently placed in order to take up new duties elsewhere; they have had to undertake strange jobs and carry them on at all hours of the day and night. All these changes have been carried out with never so much as a word of remonstrance, because it has been realized by all that they were made for the common—indeed, we may say for the National—good. If such tasks have not been as easy elsewhere, the reply must be made, "Why should you expect it? What have you done for the last quarter of a century to share with your workmen the prosperity of your undertaking?" In the majority of cases there could be but one answer.

If I had not been an advocate of co-partnership before the war, experience since its outbreak would have made me one. Over and over again I pay tribute to the far-seeing man who planted in our midst the tree which has since borne such sustaining fruit; and the best wish I can offer co-partners in this Christmas season is that, despite this terrible war, co-partnership may flourish stronger than ever in

THE NEW YEAR.

PENNY MANTLE SCHEME AT SCARBOROUGH.

Much interest has been aroused by the announcement of the Scarborough Gas Company that in future they will supply and fix free of charge the best quality upright or inverted mantles at 1d. each. If desired, consumers purchasing mantles at 1d. each may fix them for themselves; but in certain cases the Company reserve to themselves the right to fix mantles sold at this reduced price, or to make a charge of 6d. per mantle. Further, upright or inverted incandescent burners, complete with mantle and globe, will be supplied and fixed free of charge in place of existing flat-flame burners. When making this announcement, the Company say: "Incandescent burners give eight hours brilliant light for 1d. They can now be freely used, as the cost of renewing mantles will be so small."

While the consumers seem to be much appreciating the Company's enterprise, of which advantage is being extensively taken, the plumbers and gas-fitters feel that the scheme will have a serious effect on their businesses. It has been decided by the local Plumbers' Association to call the members together, and in the meantime to make inquiries. It should, however, be mentioned that an official of the Gas Company has called upon plumbers in the town, offering, so as to minimize their losses, to purchase their stocks of mantles at invoice price.

In the course of an interview with a representative of the "Scarborough Weekly Post," Mr. A. Philip Allan (the Manager and Secretary of the Company) said that, though the cost to the Company of each mantle was 3½d., the loss that would be incurred in their sale would be made good out of the profit derived from the production of the benzol which is being extracted from the gas at the request of the Government. He pointed out that the dividend of the Company is limited to 5 per cent.; and therefore any additional profit is placed to the consumer. The Company desire to popularize incandescent lighting, and to give the consumer some return for the poorer quality of gas which is now necessarily being produced. With incandescent burners, the consumers will, on the whole, get a better light with a poorer quality of gas. On the point of the position of the local plumbers, Mr. Allan, judging by the quantity of mantles sold by the Company, is of opinion that their sales can only have represented a small percentage of the mantles used in the town in a year. With regard to the future, Mr. Allan said what he had in view was the supply of all gas apparatus free of charge, and the reduction of the price of gas to the lowest possible limit.

Increase in Price at Newport (Mon.).—The Newport (Mon.) Gas Company announce an increase of 3d. per 1000 cubic feet in the price of gas.

COLONIAL GAS ASSOCIATION.

The report of the Directors for the year ended June 30, which will be submitted at the meeting to be held on Thursday, states that the sales of gas show an increase of 34 million cubic feet, or 21 per cent., as compared with those for the previous year. This substantial increase has enabled the Directors to avoid making any addition to the prices charged for gas at the various works, notwithstanding the heavy increase in the cost of all materials, and of labour. The share capital was increased during the year by the issue of 7987 preference 6 per cent. shares of £1 each. Since the close of the year, this number has been further increased by 5495 shares. The accounts show that, including the £1891 brought forward from the previous year, and after providing for debenture and other interest, and allowing fully for renewals and depreciation, the amount available for dividend is £9836.

The Directors recommend payment of dividends as follows: On the preference shares, 6 per cent. per annum (less tax) for the period ended June 30, 1916; on the ordinary shares, 5 per cent. per annum, tax free (equivalent to £6 1s. 3d. per cent., less tax of 3s. 6d. in the pound), leaving £1878 to be carried forward. The dividend on the preference shares will be paid in cash; but owing to the urgent need of all available funds for capital purposes, it is proposed to pay the dividend on the ordinary shares by the allotment of one preference share of £1 for every twenty ordinary shares, and fractions in cash; and a resolution to this effect will be submitted to the meeting. The continued rise in the value of money and the urgent need for further capital, not only for extension of works and mains, but also for reduction of loans and bank overdraft, which amounts to £17,170, make it, in the opinion of the Directors, desirable to increase the rate of dividend on the preference shares from 6 to 7 per cent., and the issue of such shares from 30,000 to 50,000. Resolutions to this effect will also be submitted.

AMSTERDAM MUNICIPAL GAS-WORKS.

Report for 1915.

As compared with the corresponding months of 1914, the first seven months of 1915 showed a fall in gas production equal to 3·29 per cent. This decrease is to the extent of about one-third caused by the reduced public lighting. In August, matters improved so far that the total gas production for 1915 showed only a fall of 0·67 per cent. compared with 1914, and was still 2·16 per cent. over 1913. Considering the serious competition of electricity, and the larger number of electric slot-meters, these results are certainly favourable.

The total supply of coals during 1915 was: German, 133,850 metric tons; British, 104,992 tons; Dutch, Belgian, American, 2656 tons—total, 241,498 ton. Stocks on Jan. 1, 1916, amounted to 66,799 tons.

The gas production per metric ton of coals was: Western works (horizontal retorts), 10,607 cubic feet; eastern works (horizontal retorts), 10,475 cubic feet; southern works (vertical retorts), 12,978 cubic feet; northern works (horizontal retorts), 11,223 cubic feet—average, 11,507 cubic feet. The total gas production was 3644·48 million cubic feet. The coke produced was 169,446 metric tons; and the heating of the retorts required 15,340 tons, equal to 18·113 per cent. of the coal carbonized.

Carburetted water gas is made at the western works (Humphreys and Glasgow) and at the eastern works (Cutler and Sons). The production was 937·12 million cubic feet, for which there were consumed 15,221 metric tons of coke and 7013 tons of gas oil, giving per ton of coke a gas production of 61,563 cubic feet. The quantity of water gas in the mixed gas was 25·71 per cent.

The production of tar was 10,473 metric tons, or 4·451 per cent. of the weight of the coal carbonized. There were produced 87,112 tons of liquor, of which 86,966 tons were treated in the sulphate works; the total amount of nitrogen present in fixed and volatile form being 526 tons. From this there have resulted 2377·5 tons of sulphate of ammonia, or 1·01 per cent. of the weight of the coal carbonized.

The number of ordinary meters in use at the end of 1915 was 50,700; being an increase during the year of 248. Slot-meters increased 3123; the total at the end of the year being 79,057, only 37 of which were wet meters. Of the total gas supplied, 44·12 per cent. was sold through prepayment meters. The average consumption per slot meter was 18,991 cubic feet; the largest consumption registered by a single slot-meter being 114,725 cubic feet. The gas sold, not including public lighting, amounted to 32,719·9 million cubic feet. The population during 1915 being 612,484, this makes a gas consumption of 5342 cubic feet per head, as against 5515 cubic feet in 1914.

The average price of the German coals, including carriage into stock, was 18s. 8d., and that of the British coals £1 3s. 3·6d. per metric ton, as against 14s. 4d. and 18s. 5·8d. in the preceding year. Carbonizing wages per metric ton of coal amounted to 2s. 6·5d.—a figure slightly lower than that for 1914.

The net cost of producing 1000 cubic metres of coal gas was £3 4s. 6·1d. in 1915 and £3 6s. 4·8d. in 1914, and of carburetted water gas £2 4s. 11·8d. in 1915 and £2 2s. 4·8d. in 1914. The total cost of the mixed gas at the consumers' meters was £4 15s. 5·2d. in 1915 and £4 15s. 3·8d. in 1914. The revenue being £5 19s. 5·2d. and £5 19s. 1·5d. respectively, there was a net profit per 1000 cubic metres sold of £1 4s. in 1915, and £1 4s. 1·8d. in 1914.

Dublin Gas-Stove Hiring Rate.—There has been some hostile Press criticism in Dublin, on the decision of the Alliance and Dublin Consumers' Gas Company's to increase the hiring rate for gas cooking and heating stoves from 2s. 6d. to 5s. per quarter, as from Jan. 1. The Company state that the increased hire will affect 4100 out of over 62,000 consumers. To make the stoves popular, they say, hiring had to be at first at unremunerative rates. For repair and renewal a large staff is required, whose wages are higher than formerly; while the price of parts has gone up. It is hoped that the increase will enable the Company to work without incurring any loss.

INCOME-TAX REFUNDS.

In the "JOURNAL" a fortnight ago, there was reproduced a statement issued by a gas company for the guidance of shareholders in the important matter of income-tax refunds. An intimation in the following terms has, since the income-tax began to display such vigorous growth, been sent out with the dividend warrants by Mr. R. Lockey, the Manager and Secretary of the Morpeth Gas Company, Limited.

INCOME-TAX.

Shareholders are reminded that total exemption may be claimed when the income from all sources does not exceed £130. Incomes under £400 allowed abatement of £120. Incomes between £400 and £600, an abatement of £100. Between £600 and £700, abatement of £70. A lower rate of tax is also allowed on unearned incomes, where the total income from all sources does not exceed £2000.

Where a dividend is paid free of tax, shareholders who are entitled to exemption may claim for the amount of tax upon such dividend. The tax payable upon the ordinary shares in the accompanying warrant is 3s. 6d. in the pound for the year.

The necessary forms for reclaiming income-tax can be obtained from the local Surveyor of Taxes.

The accompanying statement will be accepted as a voucher by the Income-Tax Authorities.

PROFIT-SHARING IN NEW YORK.

The Consolidated Gas Company of New York and their affiliated Gas and Electric Companies—including those in Yonkers, Westchester, Northern Westchester, Queens, and the Bronx—have adopted a profit-sharing scheme, which has been explained in the following terms to the "American Gas Light Journal" by one of the executive officers of the Company.

It is increasingly recognized that profit-sharing in some form promises more than anything else to stimulate the interest of the employees in the success of the undertakings with which they are identified. This relationship tends especially to promote individual and collective effort and a better spirit of co-operation in the various departments of the complex organizations now required by the larger public utility corporations to render satisfactory service. Feeling, on the part of an employee, of an immediate personal interest, by having a direct part in the results, tends perhaps more in this than in any other way to secure and maintain that standard of excellence so essential in the conduct of the utility which seeks the highest attainable ideals in the public service.

In the desire to meet in the fullest sense their obligations to the public of New York, the Directors of the Consolidated Gas Company and the New York Edison Company and the affiliated Gas and Electric Companies have been studying this question with a great deal of care for some time past. The Directors of these Companies have now decided to pay to all employees, other than those of the executive and administrative staffs, receiving not over $3000 per annum, a percentage upon their salaries or wages equal to the dividend rate paid to the stockholders of the Consolidated Gas Company. Quarterly dividends are now paid at the rate of 7 per cent. annually; and, consequently, these employees, some 17,000 in number, will receive a like rate, which will approximate $1,000,000, in addition to their salaries and wages. The first payment will be made this month to all employees who, on Nov. 30, will have been six months or longer in the service of the Companies; and, as in the case of the payment of dividends to the stockholders, these payments will be made by cheque.

It is very gratifying to the Directors that they are thus able to show to their employees, upon whom the satisfaction of the public with the service of the Company so largely depends, their recognition of the faithful and efficient discharge of their duties, by the adoption of this method of profit-sharing.

TRINITROTOLUENE POISONING.

A lengthy statement on the subject of trinitrotoluene poisoning, officially communicated by the Ministry of Munitions, appeared in a recent issue of the "Lancet."

In the opening portion, it is pointed out that before August, 1914, there had been little practical experience of the toxic action of trinitrotoluene ("T.N.T."). No ill-effects had been observed from the small quantities used, and it was generally believed to be much less toxic than dinitrobenzene, which had been manufactured in this country on a small scale for many years and been used as an ingredient of explosive powders in a proportion rarely exceeding 15 per cent. During the past year, however, T.N.T. has shown itself to be dangerous to the health of at least a minority of workers coming into contact with it, and has produced fatal toxic jaundice in fifty cases out of many thousands of workers engaged.

As soon as the dangers from T.N.T. became obvious, administrative measures for their control, including medical supervision in all the factories, were taken, and scientific investigations into the modes of action of T.N.T. were organized. Whatever light is being thrown upon T.N.T. poisoning by such investigation is communicated to the responsible medical officers in the factories concerned for their guidance. Many cases of illness, however, attributed rightly or wrongly to T.N.T. poisoning, have, or may, come to the notice of medical men outside the factories; and it appears desirable accordingly to make generally known to them the present state of knowledge in this matter, as on them now devolves the duty of notifying toxic jaundice contracted in a factory or workshop, to the Chief Inspector of Factories at the Home Office, London. Apart from such statutory notification, communications from medical men based on observations of any serious effects attributed to T.N.T. would be valued, and might be addressed to the

same quarter. It is hoped to make in the early future further communications of results obtained by investigation.

Trinitrotoluene, also known as T.N.T. and trotyl, is a high explosive obtained by nitrating toluene—a product of coal-tar distillation. Toluene is a benzene compound in which one hydrogen atom of benzene (C_6H_6) has been replaced by the radicle CH_3. In the process of nitration three other hydrogen atoms are replaced by the nitro radicle (NO_2), and the formula for T.N.T. may be written, $C_6H_2(NO_2)_3CH_3$. This body is solid at ordinary temperatures, in which state it can be reduced to a fine powder. It melts at about 80° C.

When the skin or hair is exposed to T.N.T. by contact, a characteristic yellow or tawny orange stain is produced, which lasts in the integument for some weeks. Derivatives of T.N.T. produced by the action of alkalies have characteristic colours. If a dilute solution of T.N.T. is treated with alcoholic potash, a deep pink colour, changing to purple and then turning brown, results. Skin which has absorbed T.N.T. has a bitter taste to the tongue, which is removable by solvents of T.N.T. but not by water, as in ordinary washing.

T.N.T. is soluble in oils and greases as well as in acetone, ether, benzene (benzol), xylene (xylol), and other compounds; and the importance of this will be referred to later. Alkaline alcohol changes the yellow stain in the skin to pink or purple, and the T.N.T. thus chemically changed is soluble in, and can be washed out by, water.

T.N.T. is used alone as a fine powder, or in a flaked condition, or in the molten state from which T.N.T. in vapour escapes and is deposited in the form of a fine crystalline sublimate upon any surface of lower temperature than about 70° C. When mixed with 40 to 60 per cent. of ammonium nitrate it is known as amatol, and with 20 per cent. of ammonium nitrate as ammonal. T.N.T., as used, is often impure, and contains traces of dinitrobenzene and other similar bodies. But investigation has produced no evidence of poisonous properties residing in impurities. Pure and crude T.N.T. are equally toxic, and in no cases have the separated impurities been found more potent than pure T.N.T. The separate T.N.T. isomers have also been carefully tested, and their toxicity appears to lie either at or slightly below the toxicity of T.N.T. Of the cases showing jaundice, about 27 per cent. have arisen from pure T.N.T., 67 per cent. from amatol, and 6 per cent. from ammonal. Possibly the hygroscopic nature of ammonium nitrate may assist absorption through the skin.

In view of the old experience of dinitrobenzene poisoning, it would appear *a priori* likely that "T.N.T." can be absorbed in a dangerous degree by the skin; and recent experiments establishing this absorption will be mentioned below. Fine dust and fumes will reach, besides the exposed skin surfaces, the mucous membranes of nose and mouth—perhaps even the lungs themselves—and must inevitably be swallowed either in the saliva or with the mucous secretions from the nose and windpipe.

T.N.T. may be recovered unchanged from the fæces, and is probably there present in most of the workers. In the urine it does not exist free except by contamination during collection; but in the great majority of all workers it is present in greater or less amount in the urine, though in a combined state. In properly collected urine, not directly contaminated with T.N.T. dust, T.N.T. solvents fail to extract any of the substance. Its presence may be shown, however, by liberating it by acid from a compound in which it is fixed, when it may be revealed by its ordinary reactions. This urine test will be given in detail below. Further investigation is now in progress, but it would appear probable that free T.N.T. in the intestine is combined in the presence of reducing substances, just as other aromatic bodies in ordinary digestion of proteins are converted to ethereal sulphates, and so eliminated harmlessly by the kidney.

The statement then proceeds to group the symptoms of the poisoning under various heads, and afterwards there are the following remarks on preventive measures.

In the manufacture and use of dinitrobenzene before the war need for minimizing the dose was well recognized either by arranging for alternation of employment or by allowing the workers such time off as was necessary for their recovery. Experience had shown that long hours of continuous work were impracticable. Similarly in some large factories where the number of workers and the nature of the processes carried on has permitted of systematic alternation of work on T.N.T. with other work away from it, no cases of toxic jaundice have been reported. In others, where on occurrence of cases alternation has been arranged, the number notified has fallen. Hence, in considering remedial measures against the danger of T.N.T. in circumstances demanding the utmost output, the aim is, apart from removal of fumes and dust, to employ workers over 18 years of age, to make suitable canteen provision, so that workers can obtain good food on factory premises, to eliminate those showing early signs by frequent medical examination, and to alternate the work or reduce the length of the shift if practicable. Complete protection of the skin is very difficult of attainment, but investigation is being made as to whether this may not perhaps be overcome in another way by the use of solvents such as have been mentioned (benzol, xylol, &c.).

The prophylactic measures adopted, for example, in the Royal Arsenal are as follows:

1.—Only persons in good health, and as far as practicable between the ages of 20 and 50, are employed on T.N.T.
2.—All workers are inspected by a medical officer once a week.
3.—Special clothing is provided, also veils, respirators, and gauntletted gloves.
4.—Employment is alternated fortnightly.
5.—Adequate ventilation in workshops is arranged for.
6.—Mechanical devices are adopted for preventing dust and getting rid of fumes.
7.—Workers are warned against sleeping in the clothing worn at the factory, and advised to have a complete change of clothing on reaching home.
8.—Facilities are provided for obtaining suitable and sufficient food at proper intervals. Milk is supplied free on the arrival of the workers.
9.—Washing of hands and face is insisted upon before meals, and before leaving the factory. Neutral soap and individual towels are provided.

ZÜRICH GAS UNDERTAKING.

Report and Accounts for the Year 1915.

The following is a summary of the report and accounts of the Zürich Corporation gas undertaking for the year 1915.

The supply of coal was generally adequate; but owing, to transport difficulties, a sufficient quantity could not be obtained from German pits, the deliveries from which had to be supplemented by Belgian coal, which was very costly. Moreover, considerable quantities of coal which is not ordinarily used for gas making had to be carbonized in default of gas coal. Revival of business caused the output of gas to increase by 1·8 per cent. over that for 1914, which showed an increase of only 0·11 per cent. over 1913. Coke, tar, and ammonia were in good demand; and the receipts from them helped to balance the rapidly rising cost of coal. Many workmen remained under arms, and had to be replaced by unskilled hands.

A new sulphate of ammonia plant, capable of dealing with about 16,500 gallons of crude liquor in twenty-four hours, was brought into use in April, and a tar-distilling plant, on Kubierschky's system, handling about 24 tons in twenty-four hours, towards the end of the year. An elevated wrought-iron tank, of 44,000 gallons capacity, was provided for the storage of tar oil. One bench of eight settings of inclined retorts was reconstructed with retorts of larger cross section, which increased its gas making capacity by 20 per cent. A high-pressure main, 4·42 miles in length, and 2½ to 6 inches in diameter, has been provided to transmit gas to the distributing systems in three of the suburbs, in which 1065 consumers had been secured by the end of the year.

The carbonizing plant comprises 24 beds of nine inclined retorts, six beds of 18 vertical retorts, ten beds of 10 vertical retorts and (for testing purposes) one setting of two horizontal retorts. The coal carbonized in the year amounted to 115,392 metric tons of ordinary coal and 155 tons of cannel. The total quantity of gas made was 38,441,600 cubic metres (1,357,757,310 cubic feet); the average make per ton of coal carbonized being 11,937 cubic feet, as compared with 12,501 cubic feet in 1914. The make of gas in the inclined retorts was only 10,764 cubic feet per ton (against 11,124 cubic feet in 1914); the higher average make being due to the vertical retorts, into which steam is admitted towards the close of the carbonizing period. Carbonizing wages per 1000 cubic feet of gas made showed an increase of 9·4 per cent. over 1914. The gas sold amounted to 86·87 per cent. of the production; 4·26 per cent. being unaccounted for, and the remainder used in public lighting and on the works. The consumption in the town area, exclusive of public lighting, &c., amounted to 5591 cubic feet per head of the population, as compared with 5263 cubic feet in 1914. In regard to coke, the quantity consumed as retort fuel averaged 14 per cent. by weight of the coal carbonized in the inclined and vertical settings of eighteen retorts, and 15 per cent. in the vertical settings of ten retorts.

The yields of bye-products, expressed in percentages by weight of the coal carbonized, were as follows, the corresponding yields for the year 1914 being given in brackets: Coke, 71·15 (70·00); real ammonia, 0·2219 (0·2328); tar, 5·06 (6·11); retort carbon, 0·017 (0·203); and prussian blue in cyanide sludge, 0·038 (0·054). Owing to the scarcity of fuel, coke was in increasing demand for industrial uses, and good prices were obtained for it. The descriptions of coal carbonized gave a larger yield of coke than is ordinarily obtained, and afforded a welcome addition to the fuel supply. Owing to the scarcity of fuel oil, the demand for tar and tar oils was greater than the supply could meet, and all produced was disposed of locally at good prices. There was a greater demand for retort carbon, owing to the cessation of imports. Very much better prices were obtained for ammonia; all the liquor being worked up to sulphate as soon as the new plant became available. Prussian blue did not fetch appreciably higher prices. The cyanide sludge contained on the average 7·8 per cent. of prussian blue, and 6·6 per cent. of ammonia, which figures are considerably lower than previously, owing solely to the alteration in the coal carbonized. The new sulphate plant produced without difficulty a salt containing 20¾ to 21 per cent. of nitrogen (24·9 to 25·5 per cent. of ammonia). In addition to routine testing, and some photometric tests made for the military authorities of acetylene flare lamps, the laboratory carried out two special investigations on the efficiency of important types of gas-stoves and on the dependence of the light of the Hefner lamp on atmospheric conditions. Reports on these investigations have already been published in the "JOURNAL" (Vol. CXXXII., p. 378, and Vol. CXXXIII., pp. 89, 151).

There were at the close of the year 7782 public lamps with a total of 9275 burners. Automatic igniting devices were fitted to 2710 lamps. The consumption of mantles averaged 5·03, and of chimneys 2·11 per burner per annum; the average life of a mantle being 498 burning hours, as against 461 in 1914. An addition during the year of 2802 prepayment meters raised the total number in use at the end of the year to 11,045. The number of employees of the undertaking in addition to officials on the staff was 393, of whom 222 were employed at the works at Schlieren and 171 in the town. Milk was sold to employees at the works at a price equal to 4·35d. per quart, which involved the undertaking in a loss of 6¼d. per gallon. Cups of coffee and tea were given free to employees at a cost to the undertaking of about £58.

The accounts for the year show a net profit of 1,571,627·29 frs. (about £62,865), which is an increase of about £2321 on the net profit for 1914.

Kenilworth Gas Bill.—The intention of the Kenilworth Gas Company to apply for an Act of Incorporation was referred to by Mr. C. Randall, the Chairman of the Urban District Council, who said they must look after the interests of themselves, the ratepayers, and the gas consumers. He thought personally that any Private Bill promoted by a gas or water company should have a purchase clause included. At the same time, the present was a very inopportune moment to go to Parliament.

MUNICIPAL WATER-WORKS AND WAR SERVICE.

The Municipal Water-Works Association recently succeeded in obtaining the issue of an order by the Ministry of Munitions extending section 7 of the Munitions of War Act, 1915, to such water-works authorities as are in possession of certificates to the effect that the water supplied by them is of importance for the purpose of carrying on munitions work. This enables such authorities to grant or refuse leaving certificates.

The Hon. Secretaries (Messrs. W. Terrey and C. G. Henzell) and the Secretary (Mr. G. P. Warner Terry) now intimate that, as the result of correspondence between Colonel Porter, J.P. (the President), and Major Noel French, D.A.A.G., of the Department of the Director of Recruiting, a deputation waited upon Major French at the War Office on the 1st inst., when the general question of the position of water undertakings in regard to the depletion of their staffs for war service and the question of substituted service were discussed. As a result, it was agreed that water-works authorities are to furnish (1) a complete list of men who are now serving with H.M. forces, and (2) a list of men of military age belonging to Class A (general service) or unclassified, at present in the employ of water-works undertakings. The object of supplying these lists is to comply with a scheme of substitution now being framed, on the basis that if any further men are taken from their present service they should be replaced by suitable substitutes (generally in the proportion of five to four or thereabouts) who can be spared by the military authorities from among those men who had previously left the respective water-works authorities. The notification is accompanied by schedules showing the form in which the particulars are to be sent to Major French.

NOTES FROM SCOTLAND.

Summer Time Act in Scotland.—The Convention of the Royal Burghs of Scotland recently instructed their agent to send to all the Scottish burghs (203 in number) a circular asking for opinions as to the working and effects of the Summer Time Act. Information has been obtained from 183 burghs; and this has been fowarded to the Departmental Committee which has been appointed to report on the subject of daylight saving. All the burghs that replied were of opinion that the effects of the Act had been beneficial; and most agreed that no great difficulties had arisen out of it. Nearly all the burghs expressed the view that the Act had caused an improvement in health—school children being specially mentioned—and one burgh (Armadale) went the length of stating that the death-rate and infantile mortality had been reduced. Various alterations in the Act were suggested. In all, 81 burghs wanted the summer time period to extend from April 1 to Sept. 30; while 30 were of opinion that it should start a month later.

Gas Supply in Lanarkshire.—At the statutory December meeting of the Lanark County Council (Colonel King Stewart presiding) the Parliamentary Bills Committee submitted a report with reference to the Bill being promoted for the county water and gas supply. It was stated that all the clauses of the Draft Provisional Order had now been adjusted with the Scottish Office, other than the clause relating to the supply of gas. As a result of conferences which had taken place with the officials of the Scottish Office, this clause had been adjusted in a way which it was thought would meet the views of the Scottish Office officials; but a letter had recently been received from the Parliamentary Agents intimating that the Scottish Office now desired further amendments to be made which would render it necessary for the approval of the Secretary for Scotland to be obtained to any scheme under which the Sub-Committee proposed to be appointed under clause 70 of the Order for districts in the county might resolve to unite for the purposes of gas supply, and would also render it necessary that the Secretary for Scotland should give his consent to any borrowings from time to time by the County Council of sums required for carrying out the purposes of the Gas Supply Act. The Clerk (Sir Thomas Munro) having explained the purpose and effect of these amendments, the Committee, while thinking that their insertion was not called for in the circumstances, decided to leave the matter in the hands of the Chairman, the County Clerk, and the Clerk of the District Committee (Mr. Whyte), with full power to adjust the clause to include these amendments, if the Scottish Office insisted on their insertion in the Order. The County Council approved.

Increase in Price of Gas at Paisley.—The Paisley Town Council have decided to increase the price of gas 1d. per 1000 cubic feet for all supplies, except by prepayment meter, and to increase the charge for electric lighting by ½d. per unit, except in the case of one firm. A new scale of charges for power supply was also approved.

The Exhauster and its Place in a Gas-Works.—A paper on "Gas-Exhausters" was read by Mr. John Smith, of the Tradeston Gas-Works, at the last meeting of the Glasgow Corporation Gas Department Foremen's Association. After sketching the improvements that have been made in the construction of these useful appliances on a gas-works, the author described the installation at the Tradeston works. The importance of lubrication was emphasized, and Mr. Smith asked his audience, Why not put the exhausters before the condensers, where there are so many more oils in the gas? It appears to him that, if this were done, very much less (if any) lubrication would be required. He admitted, however, that there are certain points against it. For example, the heat of the gas, the larger volume of condensable vapours, and the seals of the condensers. Finally, there were some remarks on retort-house governors and bar-valves. The next paper will be by Mr. John M'Isaac, on "Gas for Industrial Purposes;" the meeting to be held on Jan. 19.

Gas-Workers' Wages at Barry.—The Barry Urban District Council have decided to refer to the Board of Trade an application by the employées at the gas-works for a wages advance of 6d. per day, and one by the stokers for an advance of 6s. per week.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 23.

The London tar products market continues to maintain its firm position, and is unaffected by the proximity of the Christmas holidays. Creosote is in strong demand for fuel purposes for home use; the price being fixed at 75s. net per ton in bulk at makers' works. Pitch still shows an upward tendency; business for export having been done at 22s. net per ton *ex* works, and a further hardening of the market is expected. Solvent naphtha 95-160 remains at about 2s. 3d. net and naked. There is no change to record in other light products.

Sulphate of ammonia is very firm; business for prompt delivery has been done at £18 2s. 6d. net per ton for 25 per cent. quality filled into buyers' bags at producers' works, and makers are obtaining a premium for forward delivery.

Tar Products in the Provinces.

Dec. 22.

There is nothing of particular note to report concerning the price of tar products. Little business is being transacted in pitch; the question of freight being a difficulty. Solvent naphtha is quiet again, and some sales are reported at lower prices. Heavy naphtha is steady; but there is plenty to meet the demand. Creosote is firm.

The average values of gas-works products during the past week were: Gas-works coal tar, 19s. 3d. to 23s. 3d. Pitch, East Coast, 16s. to 16s. 6d. per ton; West Coast—Manchester 15s. to 15s. 6d., Liverpool 16s. to 16s. 6d., Clyde 17s. to 18s. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 9d. Heavy naphtha, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 3¼d. to 3½d. Heavy oils, in bulk, North, 3⅜d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene salts, 70s. to 80s., bags included. Anthracene, "A" quality, 2¾d. to 3d. per unit; "B" quality, ¾d. to 1d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Dec.* 22.

Throughout the week the demand has continued good for delivery this year, as well as over the early months of next year, and every parcel offered for export has been taken up at a further advance in price, although permission to ship to neutral countries has only been given to a limited extent. The nearest values to-day are £18 12s. 6d. per ton f.o.b. Hull, £18 15s. f.o.b. Liverpool, and £18 17s. 6d. f.o.b. Leith for December delivery; while for January-June £19 per ton at the best ports has been obtained in several instances.

Nitrate of Soda.

The strength of this market is well maintained, and holders on spot now require 19s. 9d. per cwt. for ordinary quality and 20s. 3d. for refined.

Manchester District Tar Prices.

The average price realized for tar, based on the value of the products for November deliveries in the Manchester district, was 23s. 8d. per ton.

Sulphate of Ammonia.

From another source we understand the price keeps firm; quotations being as follows: Outside London makes, £17 5s.; Hull, £17 17s. 6d. to £18; Leith, £18 5s. to £18 7s. 6d.; Liverpool, £18 5s. to £18 7s. 6d.; Middlesbrough, £18 5s.

COAL TRADE REPORT.

Northern Coal Trade.

Though the arrivals of steamers have been fairly good, shipments have been interfered with by the stormy weather. Demand has been fuller, and production has been heavier—as usual just before the holidays. Best Northumbrian steam coals are steady at about 30s. per ton f.o.b., second-class steams are from about 22s. 6d. to 24s. 6d., and steam smalls are plentiful at from 18s. to 20s. Actual prices, however, depend very much on the time of delivery possible. In the gas coal trade the demand is very brisk, and prices are on the whole steady. Best Durham gas coals are about 25s. per ton; but for neutral countries the prices are higher. Second-class gas coals are quoted at 20s. to 21s. per ton f.o.b.; while "Wear Specials" are from 30s. to 32s. 6d. The output of gas coal is well taken up. It should, however, be borne in mind that the wages of miners are largely ruled by the realized price of the produce—that is, the price at the mines. Complaint is being made of the "control" of prices, which checks the average, and thus affects wages. Less coal is being sold forward; but the current contracts are heavy if steamers were more plentiful. Gas coal freights, from Tyne to London, are from 15s. to 16s. The prices quoted for good gas coke (the production of which is heavy at this season) are from 33s. to 34s. 6d. per ton f.o.b. in the Tyne. Coke freights to Dunkirk are about 45s. 6d.

The Directors of the European Gas Company, Limited, have decided to pay, on Feb. 1, an interim dividend of 5s. per share, free of income-tax.

Lights before Dawn in Cotton Districts.

At a well-attended meeting of the Chief Constables of the principal Lancashire cotton towns, held in Manchester a fortnight ago (presided over by the Chief Constable of Accrington), it was decided to fix the lighting-up hour in the mornings, with one or two exceptions, at 5 o'clock, instead of the present hour of 6.30. Of late many complaints have reached the authorities of accidents occurring in the early hours of the morning; and this decision will be a great convenience to the tens of thousands of mill operatives and other workers who leave home in the early morning, and have to traverse unlighted streets. At the meeting (which was held in private) it was stated that efforts would be made to give reasonable lighting facilities from 5 o'clock; the only condition being that the authorities must be able to quickly shut off the lights in case of air-raids. It was further stated that the new lighting time would apply to all over the country; and that where there are reasonable complaints of inefficient lighting the police authorities would endeavour to meet them. This decision, however, does not refer to Manchester or to the borough of Oldham. The question of the lighting of the gas-lamps, &c., in the early morning there was briefly discussed at the last meeting of the Gas Committee. Mr. Isaac H. Massey (Assistant-Engineer), replying to observations by certain of the members, said the lamps were left burning all night, from 4.15 p.m. to 6.15 a.m. The lamplighters objected to turning the lamps out at 11 o'clock and getting up to light them again at 4 o'clock. Their Union backed them up; and the Chairman of the Lighting Committee decided to leave the lamps on all night, as the cost was very little more.

The Plymouth Gas Poisoning Fatality.

An inquest was held at Plymouth yesterday week, by the Deputy-Coroner (Mr. John Graves) on the bodies of John Skinner, his wife, their daughter, and granddaughter, who were found dead at No. 90, Desborough Road, on the 15th inst., as recorded last week [p. 593]. Medical evidence was given that death was due to gas poisoning. Mr. P. S. Hoyte (Engineer and Manager to the Plymouth Gas Company), said the road opposite the premises had been opened by the Company's men, and the main exposed. He found the main broken right across. It was a perfectly sound pipe in itself; and the top of it was 2 ft. 3 in. below the surface. The fracture was at a point 26 feet from No. 90, and 14 feet from No. 89, from which a complaint of a smell of gas had been received before the Skinners' house was entered by the police and the bodies found. There was no complaint of an escape of gas until between 10.30 and 11 a.m. on the 15th. It was probable the main was broken by heavy traffic, and the gas percolated through the earth into the house. The main was of cast iron. In reply to a Solicitor representing the family of the deceased, Mr. Hoyte said that 95 per cent. of the mains were of cast iron; the service-pipes were of wrought iron. They did not expect mains to be broken in a side road like this; but the nature of the fracture made him think it was due to heavy traffic. A verdict of "Accidental death" was returned. Mr. H. Wolferstan (Solicitor) expressed sympathy with the relatives on behalf of the Gas Company, who he said would give any material assistance that they could. Subsequently, Mr. H. B. Heath (the Secretary of the Company), by order of the Directors, addressed the following letter to the local papers: "In view of the abnormal heavy traffic passing over the streets of Plymouth at the present time, we think it desirable to emphasize the importance of the earliest possible notification being sent to the Company's offices of any escape of gas being noticed by members of the public within the Company's area of supply. It is suggested that any person detecting such escape should notify a police officer, call at the office, or telephone, with particulars and locality of the escape. A reward of 2s. 6d. will be paid to the person from whom the first report is received."

Shipley Gas Accounts.—The abstract of accounts at Shipley, for the year ended March 31 last, just issued, shows that all the trading undertakings yielded profits. In the Gas Department, the advance of 7d. per 1000 cubic feet in price has converted a loss of £1761 in the previous year to a profit of £238. The output of gas was 21,179,888 cubic feet less; this being largely accounted for by the restriction of street lighting.

Peterborough Gas Supply.—At the last meeting of the Peterborough City Council, the Town Clerk stated that he had communicated with Mr. J. Barton (the Manager of the Gas Company) regarding the adoption of a calorific standard; and, in reply, Mr. Barton had explained that the standard of calorific power did not yet apply to the Company, and they did not propose to alter their standard unless the Board of Trade desired it. As to complaints respecting the supply of gas and insufficient pressure, the Company, owing to the shortage of labour, were unable to make sufficient gas. They had applied to the Government authorities for the services of several men, but up to the present had not received any assistance.

Leeds Gas Supply Troubles.—There was trouble with the gas at Leeds last week—particularly in the Roundhay and Chapeltown districts, where the lights had a tendency to fire-back or jump out. A big demand on the local plumbers to attend to deficiencies did not have the desired effect; and it has transpired that the trouble has been really due to defective supply, owing to the difficulties under which the gas undertaking, with reduced and inefficient labour, is having to be worked. In consequence of reduced output of gas, owing to shortage of staff, Mr. W. B. Leech (the Engineer and General Manager) decided to make more water gas. The water-gas plant is at Meadow Lane works; and an additional installation there made three plants instead of two, the idea being to send a proportion to the New Wortley works, to be mixed with the gas made there before distribution. No water gas is made at New Wortley. It unfortunately happened that, just as this scheme was about to be put into operation, a breakdown at New Wortley made the transfer of water gas impossible; and the whole of the extra water gas had to be distributed along with the ordinary Meadow Lane gas. Meadow Lane supplies the Chapeltown and Roundhay districts. Matters at New Wortley have been put right.

A Kindly Thought at Manchester.

A letter in the following terms has been sent by Mr. F. A. Price, the Superintendent of the Manchester Gas Department, to the relatives of former employees who have fallen in the war: At the last meeting of the Committee of Management of the Gas Officials' War Benevolent Fund, it was suggested, and unanimously decided, to send out of the fund a Christmas gift of £1 to the relatives or dependants of those connected with the department who had fallen in the war, as a reminder that they were not forgotten by their colleagues. I have, therefore, pleasure in enclosing a Treasury note for this amount; and, although Christmastide will be a sad one to you, I trust this small token of remembrance will not prove unacceptable.

The New Shipston Lighting Company has been registered, with a capital of £5000 in £1 shares.

Gas Fatality at Southport.—The death took place at their residence in Southport on Monday of last week, as the result of gas poisoning, of Mr. William Potts, a local estate agent, and his wife. The gas-fire in the bedroom, it is believed, had been burning in a faulty manner, resulting in a discharge of carbon monoxide. Mr. and Mrs. Potts were found in bed unconscious, and efforts to revive them failed.

Newmarket Public Lighting Contract.—A settlement has been come to with regard to the payment to be made by the Newmarket Urban District Council to the Gas Company in the matter of the public lighting contract. Messrs. Button and Aylmer, solicitors, wrote on behalf of the Company, offering to accept the sum of £375 in settlement, under their contract for the past year. They said they did not ask the Council to pay for gas which had not been consumed; but apart from this, the actual loss to the Company in the upkeep of standards, services, mains, &c., was over £375, and they could not accept a smaller sum. After considering the matter in private, the Council agreed to accept the offer.

Complaints at Wallasey.—Speaking in the Wallasey Town Council, Mr. Chantrell (the Chairman of the Gas Committee) said he had received a great number of complaints about the low pressure and poor quality of gas. The gas was not so poor as many people spoke about; but it was not as it used to be, for well-known reasons. As to the low pressure, there was difficulty in getting any supply at all—due to lack of labour; and if the Tribunal took any more of their men, there would be no gas at all. They were left now with 126 men to carry on the works. They could not get renewals as they ought to do, and were in a most difficult position; so he hoped the public would take these facts into consideration, and not grumble.

Lighting in France.—The special correspondent of "The Times," in a message dispatched last Tuesday, stated that a Council of Ministers had decided on certain measures to meet the scarcity of coal. In the first place, the coal output will be increased, and its transport facilitated; while, secondly, a sweeping change is to be introduced in public and private lighting throughout France. All municipalities must effect a two-thirds reduction on the normal *régime* of the winter of 1913-14. Previous measures restricting private consumption of gas and electricity are now cancelled; and each individual will be allowed his normal consumption, provided it does not exceed daily a cubic metre (35¼ cubic feet) of gas and three hectowatts (100 watts) of electricity. Beyond this minimum, the consumption is restricted according to a progressive table. Bakeries and war workshops are not affected by these new regulations.

Price of Gas to Power Consumers at Tipton.—Some personalities, which there is no need to reproduce, were indulged in at a meeting of the Tipton Urban District Council, when the Gas Committee recommended increases of salary of £50 each to the Secretary (Mr. T. H. Stockdale) and the Manager of the gas-works (Mr. W. Prince), and that the price of gas to power consumers be increased 3d. per 1000 cubic feet. Mr. Salter proposed, as an amendment, that the clause relating to the recommended increase to the Manager be referred back. He alleged that, in consequence of the increase to power consumers of 3d. per 1000 cubic feet, about twelve months ago, there had been a reduction in this class of consumer, and pointed out that the recommendation to increase the salary of the Manager was carried by only the casting-vote of the Chairman. Mr. Doughty said that since the last increase no power consumers had been lost; and among the three lost prior to then was Mr. Salter. The amendment was lost. Mr. Salter then moved a further amendment that the salary of the Manager be increased £25. This was also lost; and the resolution in favour of the adoption of the report was carried.

Acknowledgment has to be made of the receipt of the customary useful diaries from the Gas-Meter Company and the Torbay Paint Company, as well as calendars from Messrs. Clayton, Son, and Co., and Messrs. Peckett and Sons.

The Morecambe Gas Committee, after having inspected several mechanical stoking plants of outside authorities, decided to recommend to the Council the adoption of mechanical stoking at the gas-works, and to purchase an Aldridge and Ranken standard plant.

Considerable damage has been caused by the bursting of a large water-main at Rivington, belonging to the Liverpool Corporation. A section of pipe, 44 inches in diameter, split in two; and the road for three-quarters of a mile was a torrent. Fields were flooded to a depth of 6 or 7 feet.

In their report for the year ended Sept. 30 last, the Directors of the Humphrey Pump Company regret that the conditions produced by the war—especially in regard to engineering firms upon whom the Company depend for the manufacture of pumps—have continued to seriously prejudice the business. Substantial progress has been made in the development of the new type of small pumps; and the Directors are pleased to state that a number of orders have been secured, including contracts for Government Departments. The chief patents have been maintained, and further patents obtained.

RATING OF WATER-WORKS.

[Extracts from a Paper read by Mr. Charles Clifton, at the Winter Meeting of the Institution of Water Engineers.]

In the first part of the paper the author alluded to two communications on the subject presented to the members in 1912, and which related in detail to the method pursued in the construction of a valuation of a water undertaking for assessment purposes. The object of the present paper was to give some suggestions which might be useful to water engineers in analyzing an assessment. The statutory definition of the net annual or rateable value for assessment purposes is defined in the Act of 1836, as "the rent at which the hereditament might *reasonably* be expected to let from year to year, free of all usual tenants' rates and taxes, and tithe commutation rent charge (if any), and deducting therefrom the probable annual average cost of the repairs, insurance, and other expenses (if any) necessary to maintain them in a state to command such rent."

Where the occupier of a water undertaking is a company trading for profit, the money actually received will doubtless form a reliable basis on which to estimate the rent the hypothetical tenant would pay for the undertaking. This is a reasonable proposition, as the undertaking has been acquired as a commercial venture for the purpose of making a profit.

The method approved by the High Courts for arriving at the assessable value of water-works is to ascertain first the rateable value of the whole by reference to the receipts and expenses. The whole rateable subject is then divided into two portions: Firstly, the indirectly productive portion, consisting of land (including the source of supply), reservoirs, and trunk mains; and, secondly, the portion which is directly productive of revenue—viz., the service-pipes and mains. The annual value of the indirectly productive portion is then estimated by the usual methods employed for valuing land and structures and deducted from the total rateable value. The balance is then allocated to the directly productive part in proportion to the gross receipts in each parish.

The method of estimating an assessment by reference to the receipts and expenses may be briefly equated as follows:

Receipts—Expenses = Profit divisible between the landlord and tenant.

The Tenant's Share = The tenant's share of the profit for his capital, skill, trading risks, and responsibilities.

The Landlord's Share = The gross estimated rental, or the gross profit remaining to the landlord after the tenant's claims have been satisfied.

The Gross Estimated Rental—Repairs and Renewals, or the Statutable Deductions = The rateable value or the net annual rental.

The Special Act.

An important preliminary is an inquiry into the Special Acts whereby the company obtains its powers. The restrictions of any Special Act would be considered before the undertaking was launched; and the hypothetical tenant would take over the tenancy subject to these restrictions. It might, of course, be found in after-years that the restricted charges and incidences connected with the capital outlay do not permit a reasonable profit being made. This, however, would be taken into account by the then intending tenant, who would only agree to pay a rental after he had given due consideration to the effect of such restrictions.

It may be found that the receipts are obtained from the maximum charges allowed by the Special Acts; and these restrictions may give rise to apparent anomalies respecting the value of the undertaking. As an illustration, a company spends a considerable sum of money in sinking deep wells and in erecting pumping-plant owing to the unsuitability of a supply hitherto obtained from surface-water. In such a case the assessment committee look forward to an increase in the assessment owing to these improvements. The property is certainly improved, but an examination of the facts shows that the rental value is diminished. At first sight this seems illogical; but the explanation is that the company are receiving their maximum receipts, and cannot raise further revenue owing to the restrictions of their Act. The sinking of the wells and the erection of the pumps not only adds to their capital expenditure, but results in a considerable increase in the expenses owing to the cost of pumping, coal consumption, and wages. There is also the extra provision necessary for repairs and renewals. The result shows that the rateable value of the entire undertaking has diminished.

Receipts and Expenses.

In testing the admissibility of the receipts obtained in previous years, it must be remembered that the hypothetical tenant is looking into the future; and investigation may show that the receipts of the last year require some modification.

For the purpose of constructing the valuation, the cost of the landlord's repairs and renewals are, for obvious reasons, omitted from the working expenses, as these are included later in the statutable deductions. The cost of repairs shown in the accounts will probably include certain repairs and maintenance, the expense of which would fall to the lot of a tenant. Such repairs and maintenance include the work connected with fittings, service-pipes, cleaning filters, and so forth. It is customary to allocate to the working expenses a fractional portion of the actual cost of the repairs to provide for such outlay. Rates are omitted in the first instance, as the amount to be eventually deducted is that represented by the rates upon the eventual assessment, and not upon the old assessment. As in the case of the receipts, the expenses should be examined before acceptance, in order to ascertain if they are normal, and if they are such as would be incurred during the tenancy.

The Tenant's Share of the Profits.

Considerable controversy may arise on this point; but most authorities agree that the only equitable way to estimate the tenant's share of the profits is by allowing a percentage of the gross receipts. The usual rule is 10 per cent.; but there may be cases where a lower percentage is justified, while in other cases even 10 per cent. would not yield a sufficient amount to tempt the hypothetical tenant to take over the responsibilities of becoming the occupier. It may, however, be taken as a general rule that endeavouring to arrive at the tenant's share of the profits by a percentage on his capital will not result in a reasonable allowance.

It must be remembered that the problem to be solved is not the capital the tenant must invest in the undertaking, but the reasonable share of the profits he would expect, and which it would be necessary to allow him in order to induce him to take over the tenancy.

The author proceeded to make some suggestions regarding tenant's liabilities in order to assist in explaining why the tenant's share of the profits must be a considerable amount to induce him to rent the premises. Continuing, he pointed out that it must not be forgotten that rent, or the landlord's share of the profits, is not necessarily what he expects or demands, but rather what he can get, or in other words what the tenant is willing to pay. Whatever may be the demands of the landlord for rent the tenant has the bargaining advantage, seeing that his capital is actual cash; or, if he is in occupation, it consists of the liquid assets which can be realized in case the tenancy comes to an end. The landlord's capital is immoveable, being tied to the soil; and therefore in the end he is compelled to take the best offer a prospective tenant will give for the property. The amount of rent and its security is not dependent upon the satisfaction derived by the landlord from his property, but upon the satisfaction and benefit obtained by the tenant.

Statutable Deductions.

As the allowance for repairs and other expenses necessary to maintain the hereditament in a state to command the rent is an average, it is customary to ascertain the expense incurred over a period of years, and from this to find the average annual expense. It does not, however, follow that the average expense during any previous period will prove to be the average expense in the future. It will often be found that if a longer period be taken into account, the average annual cost of repairs becomes less, due to the fact that the undertaking has been growing; and as regards the additions made in the immediate past, the cost of repairs does not appear in the accounts. In such cases, some further allowance will have to be made for the probable average annual cost of repairs to the extra plant.

In addition to the actual expenditure on repairs and maintenance, there is the question of the eventual renewal of the destructible portion of the undertaking, which cannot be met by ordinary repairs. This is usually arranged for by creating a sinking fund, which will provide the necessary cost of renewal at the end of the estimated period of life. It is not correct to calculate the probable average annual cost upon the assumed "life" of isolated examples of plant and buildings. The estimate should be based on the reasonable provision which a prudent landlord would make in order to meet the cost of renewals involved by the effects of wear and tear and obsolescence; and, in doing this, he would not base his estimate upon examples of longevity. It is not unreasonable to suggest that the estimated "life" of pumps, engines, and such-like plant should not exceed thirty years, and of the more enduring structures, sixty years. With boilers and mechanical filters, twenty to twenty-five years would not be unreasonable.

Apportionment.

The question of apportionment gives rise to much contention. Many undertakings extend through several rating areas governed by authorities who employ different valuers, who may hold different opinions. It is here one sees the evils of blindly adhering to the principle that an estimate of the annual value for assessment can be arrived at by taking a percentage upon the structural costs. The application of this principle may result in the undertaking being assessed at a considerably larger sum than the rateable value of the whole as ascertained by consideration of the receipts and expenses. This was foreseen in the Mile End case, 1847, and again in the West Middlesex case, 1859.

In ascertaining the annual value to be apportioned to the dead works, it does not follow that the capital outlay furnishes the true criterion of value on which one should base his calculations. Inquiry should be made as to the effective capital value to the tenant for his present needs and purposes. A water-works undertaking has to look ahead many years, and works are designed to meet not only present requirements, but those of the future. In addition to excess expenditure for present requirements, there may also be evidence to show that the outlay in the past has not been economical. The question of distinguishing between the effective capital value and the capital cost was raised in the case of *Liverpool v. Llanfyllin Union*, 1898. In this case the Court were of opinion that it was correct to make an allowance for excessive expenditure upon a reservoir having a capacity beyond existing requirements, either by writing-down the capital outlay or by reducing the rate of interest to a lower figure.

The question of excess cost of construction was raised in the case of the *Mayor, &c., of Bradford v. Keighley Union* in 1906, when the High Court upheld the principle of making due allowance for such excess expenditure. An earlier case dealing with excess capacity was *Reg. v. South Staffordshire Water-Works*, 1885.

Water Undertakings Owned by Public Authorities.

The growth of water undertakings owned by public authorities has led to considerable confusion as to how such undertakings should be rated. The difficulty seems to have arisen from the lack of any reasonable alternative being offered to the High Courts. On the one side the claim was made to rate works as unfettered tenancies, and without any restrictions, and, on the other side, to rate them in accordance with the receipts permissible by the restrictions imposed by the Act of Parliament. Cases decided in 1875 and 1876 held that the hypothetical tenant would only give such a rent as the restrictions imposed by Statute would enable him to pay. The result was consummated in 1883, when the rateable value of an undertaking was declared to be *nil* because the local authority were precluded from making a profit. The author referred to the Droitwich case in 1876, in which the Court apparently rejected the implied intention to assess a corporation undertaking at a higher rate than the water-works of an ordinary trading concern; but no question was raised as to the qualification of the restrictions. Where Parliament grants a monopoly in land, it follows that some restrictions will certainly be laid upon the promoters. The

reasonable course to adopt is to take as admissible restrictions such as would not prevent the undertaking being carried on as a commercial concern, or, in other words, the restrictions which an ordinary trading concern would accept. The restrictions, however, which are often laid on local authorities are partly voluntary. It must be remembered that the local authority represents the consumers, who are in effect the occupiers and the owners; and, therefore, the revenue obtained from the water charges is open to challenge. One body of ratepayers may prefer to pay a profitable charge for water, and apply the profits to the relief of the rates; while another body may prefer to pay an unprofitable rate for water, and to pay any losses by an extra charge upon the rates.

The difficulty of ascertaining the rating receipts has given rise to the doctrine that water-works belonging to public authorities can only be assessed by taking a percentage upon the capital value. The rule, however, still holds that "no higher rent must be fixed as the basis of assessment than that which it is believed the tenant would really be willing to pay for the occupation of the premises." [Lord Herschell in *London County Council v. Erith*, 1893.] In this case, the Court approved the principle of assessing property in the hands of a public body by taking a percentage upon the capital value. In the case of *Liverpool v. Llanfyllin*, the Court held that the total cost of acquiring land with buildings for the site of a reservoir was rightly taken into account in estimating the assessable value.

It would be incorrect to suggest that capital costs may not be a guide to the annual value in some cases, or that, providing the percentage applied and the estimate of the capital value are reasonable, the result must necessarily be unfavourable to the public authority in occupation of the works. The result may be quite favourable; but nevertheless, in considering this point, it must be borne in mind that the custom of arriving at the assessable value by taking a percentage upon capital cost is apt to lead to fallacious results. The capital value revealed by the rental value may be far removed from the original capital outlay. For this reason, calculations based on costs may lead to a false quantity; and before accepting the assessment of a public authority's water-works which has been arrived at by taking a percentage upon the capital outlay, or an estimate of the capital value as the case may be, every inquiry should be made to ascertain if the percentage applied, and if the estimate of the capital outlay is justified.

Land Covered with Water.

Section 211 (b) of the Public Health Act 1875 provides that "the occupier of any land covered with water or used only as a canal or towing-path for the same or as a railway constructed under the provisions of any Act of Parliament for public conveyance, shall be assessed in respect of the same in the proportion of one-fourth only of such net annual value thereof." The terms of this section affording the same relief was embodied in various Acts previous to 1875.

The question of what is meant by "land covered with water" was discussed in 1861 when, in the case of *Reg. v. Birmingham Water-Works*, it was held that a reservoir should be included in the category of "land covered with water," but not the pipes and mains. In the case of *East London Water-Works v. Leyton Sewers Authority*, 1870, it was held that the canal and filter-beds occupied by the Company were "land covered with water;" and, therefore, entitled to be rated at one-quarter of the assessment, while the remainder of the property was assessable at its full value. This apparently included land occupied by pipes and mains. In the case of the *Hampton Urban District Council v. Vauxhall Water Company*, 1900, which dealt with the reservoirs and filter-beds at Hampton, some dispute arose as to the inclusion of the artificial embankments which were constructed for the purpose of making the works. The effect of the decision was that the whole structure necessary for containing the water should be taken as "land covered with water." The decisions show that the words "land covered with water" need not be taken literally, and that it is incorrect to infer that the exemption only refers to that portion of the soil which is actually covered. The Hampton case disposes of such a suggestion. The effect upon water undertakings is that we have reservoirs and filters and the appurtenant structures necessary to enable them to hold water included in the category, but that mains and pipes are excluded. Apart from the question of degree, some justification doubtless exists for the exclusion of pipes and mains, especially those under the King's highway, as in earlier days it was strongly contended that the laying of pipes and mains under the roadway did not constitute a rateable occupation of land but was a mere easement, and that the dominant use of the highway is not to carry water-pipes but to permit and allow public traffic. These observations, however, may not apply to much of the works which lie between the reservoirs and the mains. There is the land used for water courses and aqueducts; and it would seem to be quite reasonable for these to form part of a claim for assessment as "land covered with water."

DISCUSSION.

Mr. F. J. Dixon (Ashton-under-Lyne) thanked Mr. Clifton for reading the paper on this subject, as he had asked him whether he would undertake the preparation of one. The reason he approached him was that he had been associated with him for the past two years in connection with the rating of the water undertaking which he (Mr. Dixon) had the pleasure of administering. He found that the majority of engineers who had the administration of water-works left the question very much to the financial staffs, which, in his opinion, was not to be commended, as he considered the engineer and manager should be the official to go into the question as to the correctness of the assessment of the undertaking. In connection with his works, two very important points arose when negotiating with the rating authorities. One was the question of works and buildings in excess of present requirements; the other was capital value *versus* effective value. In the Acts of Parliament, the authority were called upon to construct certain works so as to retain their rights. These works were constructed at a cost of £150,000—a large amount, which was part of a scheme which was to be carried out at a cost of £500,000. On the completion of the works, the rating authority saw their opportunity to in-

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crease the rateable value; and the result was they rated the works on the total capital value, notwithstanding that the authority who were the owners of the works did not derive one penny increased revenue from them. He submitted that such works, which were built in excess of present requirements, should be treated as empty property like houses. But the rating authority contended that the water authority were in beneficial occupation; and therefore the works should be rated. The authority were able to convince the rating authority that they would not be using the works for a long time; and they relieved them of the heavy burden of the full charges on the capital value. In connection with the effective value of works, it was very unfair to take a percentage of the capital value. The rating authority in the original case took the whole of the capital value of these works, and so the rating value was in excess of the effective value. Compensation works were built for the benefit of the general public, and not for the benefit of the supply of the water authority; and so he contended that the rating authorities could, with the assistance of the water authorities, treat for the poor rate on similar lines to those the district rates were treated for—that was, as land covered with water, which, as the members knew, was only one-fourth of the annual value. With regard to the remarks as to statutable deductions, the great thing was the life of the works. He thought the life of any works should be based on the assumed period of their utility, and not on the period of life at the time the valuation was made. As to land covered by water, he should like to ask whether it included catch waters, as a good many gravitation schemes were supplied with catch waters to drain water from different districts into the impounding reservoir; also what about tunnels which conveyed water like an aqueduct? These items should be included as land covered by water, and so get the benefit under the district rate.

Mr. DONALD DINWIDDY said the principal item of expenditure of a water undertaking was, of course, capital charges, and near to that came rates, so that no apology was needed for again referring to this very important item in the balance-sheet. Rating led to a great deal of fallacy. There was, however, really no need for fallacies, so long as they had reasonable men acting for the rating authority and the water undertaking. In the latest case in the House of Lords in which a water undertaking was concerned—that was, *Chertsey Union v. Metropolitan Water Board*—it was decided that an intake from the River Thames was not to be taken into account as adding to the rateable value of the land and buildings. Another point upon which the Lords gave their decision was a confirmation of the authority's assessment and of the Quarter Sessions' decision, that the value should be 4 per cent. upon the cost of the land, and 5 per cent. on the cost of the buildings, and nothing be allowed for excessive requirements or excessive foundations or obsolescence. He (Mr. Dinwiddy) suggested there was no reason to doubt the decision was right in this case. But it did not follow at all; and it was nothing against what Mr. Clifton had said in his paper, that obsolescence and excessive requirements should not be deducted from the cost—that was, the percentage for rateable value should be based on the effective value, and not necessarily on the cost. One other point was excess costs caused by the war. Of course, all water-works had had to suffer by having to pay 100 per cent. more for coal and a percentage more on wages. In a gas or electrical undertaking, where 10 and sometimes 20 per cent. had been added to their prices, they could make good the extra costs of coal and wages, but not a water undertaking, which was fixed by its maximum price; and therefore the dividends, if a profit-earning concern, must suffer. They were all now convinced that the war was not going to be over for some time; and the excess costs were likely to remain, and so might be a proper cause for a revision of assessments. He should like to make one suggestion to the members, and that was not to be over-troubled about a big assessment upon the works, provided the total value was not in excess of what it ought to be. So long as the total was not over the 100 per cent., it was sometimes of advantage to the undertaking to have a greater proportion of it upon the works and a less proportion upon the mains, because the works were generally right out in green fields with low rates, and the mains were often in the centre of cities where the rates were high. So the total value was divided between indirectly productive works which were in the country, and directly productive mains which were in the towns. Whatever was put on the works had to come off the mains; and water engineers had to see that it did.

Mr. O. WILLIAMS (Aberdare) observed that he had an application from a valuer for the length of his trunk mains. The point he wished to make was this, Would Mr. Clifton advise putting as much as possible on the directly profitable portion of the undertaking—that was, the mains? The question of dividing between the parishes did not arise on this occasion.

Mr. C. H. PRIESTLEY (Cardiff) said there was one point he should like to confirm. That was as to the increasing maintenance charge on works. He had found that during (say) the first twenty years of the life of new works, the percentage of maintenance charges had not been anything like one-fifth of what they were afterwards.

The CHAIRMAN (Mr. A. B. E. Blackburn) complimented the author upon his paper, and said that it brought the rating question right up to date.

Mr. CLIFTON, in reply, said Mr. Dixon had asked a question as to whether catch waters and aqueducts should be included as land covered with water. That was a legal question. It was possible some authorities allowed it; possibly some did not; and possibly some of the members would like to take up the matter. [Laughter.] He thought as they read his paper they would see that the rulings of the High Court on the question were pretty definite. It must be a case where the presence of water over land was essential to the beneficial occupation of the land. If this dictum had been in force at the time this question was raised about 1840, he was inclined to think the whole of a water-works undertaking would have been included as land covered with water, because the whole undertaking was for the purpose of the user of water. So far as he could find out, a reservoir on brick arches covered with a roof was land covered by water; but apparently, from early decisions, mains and pipes were held to be not

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liable to be included in the category of land covered by water. He did not see any reason why the claim should not arise. He certainly thought that the occupation of land for big aqueducts was for the convenience and user of water. But if the surface was used and covered for agricultural purposes, the user for water was subservient, and not the paramount user. The paramount user of a highway was the traffic, and not the conveyance under the surface of water. Those were the ordinary mains and pipes; and he thought, from this point of view, that a good claim ought to arise for all the other works—whether aqueducts, catch waters, and so on, up to the service reservoirs and filters. Mr. Dinwiddy had alluded to the Chertsey case; and he (Mr. Clifton) thought that the principle in this case was very much on a par with the decision in the *Liverpool v. Llanfyllin* case, in which it was held that the total cost of acquiring land with buildings for the site of a reservoir was rightly taken into account in estimating the assessable value. In this case, the cost was an expenditure of money which was foreseen; and not a penny of it was unforeseen. Here they were dealing with new property; and, in such a case, it was only reasonable to assume that the hypothetical tenant knew what was being spent and had little to say on the subject. The decision in the Chertsey case followed the same lines as that, where the expenditure was foreseen and incurred.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 20.]

Nos. 17,768—18,105.

ADAM, W. G.—"Manufacture of ammonium sulphate." No. 17,940.

ALDRIDGE, J. F. L.—"Burners for furnaces, ovens, fires, &c." No. 17,941.

BAL, C. W.—"Perforated annealing screen for gas mantles." No. 17,802.

DARIER, G. E.—"Washing and cooling gases, &c." No. 17,994.

FORWOOD, G. F.—"Treatment of hydrocarbons." No. 17,869.

GLOVER, T.—"Atmospheric gas-burners." No. 18,047.

M'LACHLAN R. W.—"Incandescent burners." No. 18,066.

M'LACHLAN R. W.—"Galleries for shade holders." No. 18,067.

MOUWERIK, P. VAN.—See Bal. No. 17,802.

SCHUBERT, A.—"Process for increasing manurial value of gas liquor." No. 17,818.

ZIMMERMAN, J. G.—"Ignition system." No. 17,988.

STOCK MARKET REPORT.

THE week before the Christmas holidays—a five-day period—exhibited, of course, its usual characteristic of slowing-down day by day until at last the maximum of quietude was attained. But it was by no means destitute of cheerfulness; and many markets improved their position. The opening from the very start was favourable, largely under the influence of the brilliant success achieved by the French at Verdun. Early consecutive dispatch from headquarters regarding this showed that it was a bigger thing than had at first been estimated. Then politics—the national, not the party variety—had a beneficent effect. The promise of a War Loan Bill at an early date, containing authority to introduce the loan if thought fit after the House had risen for the vacation and before it should reassemble in February, was received as being eminently businesslike. Mr. Lloyd George's whole speech on Tuesday was a huge success, and infused the markets with a bright and cheerful tone. This was apparent in the gilt-edged market, where Home Government issues in general showed greater or less advances. Home Rails also fully participated in the general tendency and materially improved their quotations until some little reaction was started by realization of profits. Americans again showed uncertain temper, and moved eccentrically.

The Foreign Market showed increased firmness; the French Loan being in good favour, and Chinese issues were in request. Argentines promised well at first, but were unable to retain their position, and South Africans were in much the same case. In the Miscellaneous group, shipping fell back, and textiles were dull. The first was depressed by the announcement of impending State control. The gas industry will rather welcome control of both shipping and mines.

Business in the Gas Market was quite quiet and uninteresting; and there was nothing to seize on as indicating a probable movement either one way or the other. Prices marked were much about the same as last week, and may therefore be noted as steady. The European Company will pay an interim dividend at the rate of 5s. per share, as against a 10s. rate declared a year ago. In the Money Market there was a very fair demand.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 69¼, 69⅝, 70, 70¼, South Metropolitan 79½. On Tuesday, Gas Light ordinary 70, 70¼, ditto maximum 56½, ditto preference 70¾, ditto debenture 56¾, Imperial Continental, 70, 70¼, Primitiva preference 60s., 61s. 3d. On Wednesday, Gas Light ordinary 70, 70¼, 70⅛, ditto maximum 56½, 56¼, ditto preference 70, 70½, Imperial Continental 70, Oriental 104½, South Metropolitan 79½, 80, Tottenham "A" 119, 119¼. On Thursday, Gas Light ordinary 69¾, 70, Imperial Continental 70½, Primitiva 40s., 40s. 9½d., ditto preference 60s., 61s. 3d., 62s. 6d. On Friday, Gas Light maximum 56½, South Metropolitan 80. Imperial Continental 70½, 70¾, 71, Bombay 5 1/16, 5¼. Primitiva 42s. 6d.

The Bank rate is 6 per cent.—as fixed on July 13.

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[Illustrated Advertisement Dec. 19, p. 570.]

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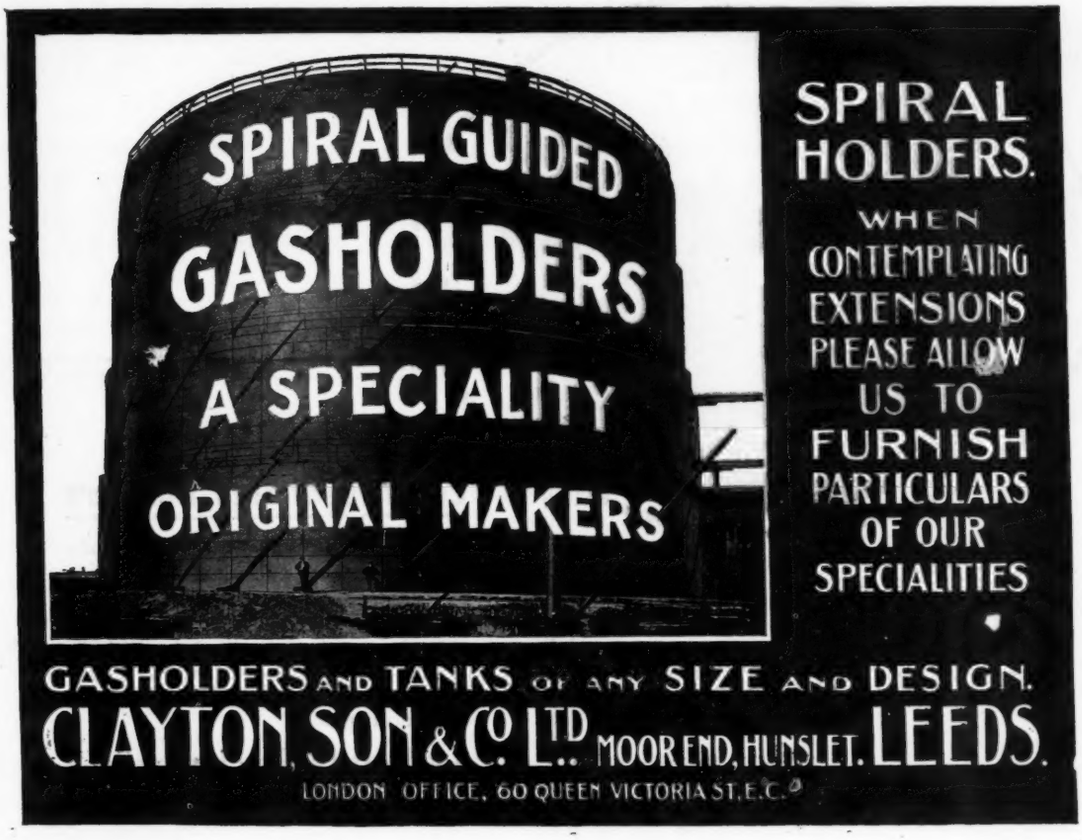
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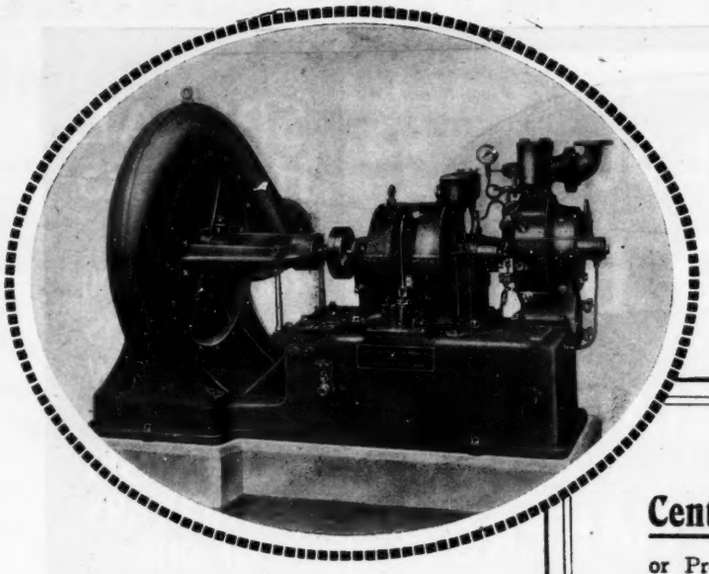

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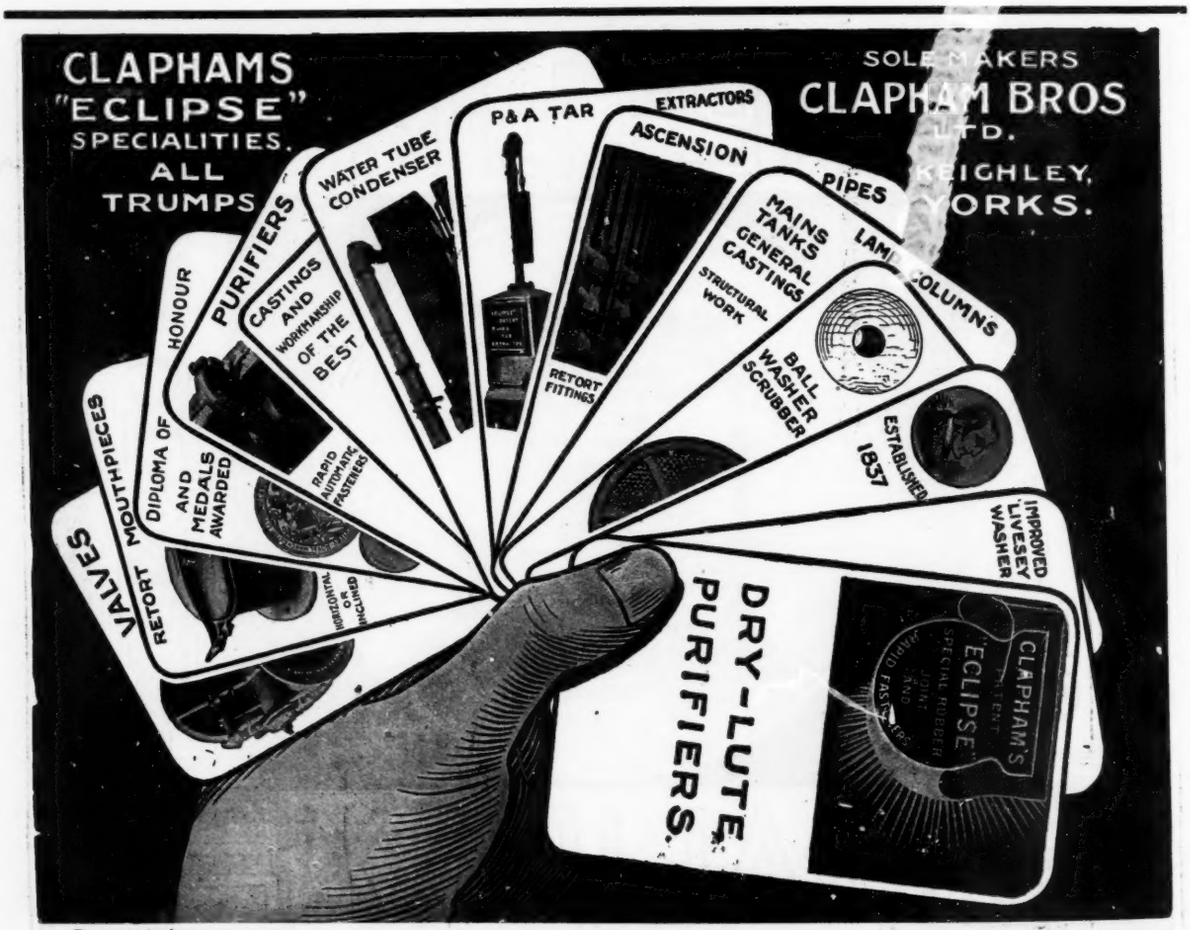

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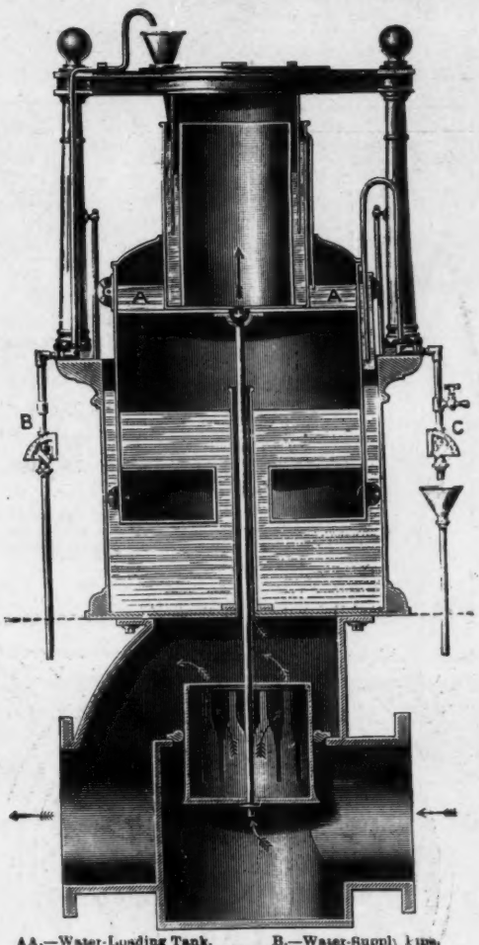

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